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ABSTRACT

Researchers explored the relationships between the great working class communities and the industries they sustained and were sustained by in terms of production, storage, and transmission of skills. First, the ethnographic literature on industrial workplaces and the working class communities associated with them was reviewed. Next, lengthy interviews were conducted with eight steelworkers who had been employed at Stelco in Ontario, Canada, since at least the 1970s. The first part of the study focused on nonformal skills transmission in the community, and the second focused on nonformal mechanical/manual skills in the plant and how they are learned and transmitted among workers. Particular attention was paid to the nonformal skills that have traditionally been sustained by workers among themselves and that are now at risk of disappearing because of the combination of (1)the downsizing that dismantles great working class communities; (2) the technological and managerial restructuring of the steel industry; and (3) the increasing substitution of formalized and institutionally controlled forms of training for the nonformal modes of training among working class men. The study also revealed that the processes of experiential learning that are still occurring at the plant are not well defined and do not appear to be valued by the company. (Contains 39 references.) (MN)

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Storing and Transmitting Skills: The Expropriation of Working Class Control[1]

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With Stephan Dobson

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Part I Introductory

This monograph comes out of a study that proposed to explore the relationships between the great working-class communities and the industries they both sustained and were sustained by in terms of the production, storage and transmission of skills. Among men so-called "manual skills" were learned in part experientially, on-the-job, but they were also learned intergenerationally, both in the community and in the workplace. The last twenty or thirty years of economic reorganization has radically undermined the engine of skills storage and transmission vested in a social organization among working class men intersecting workplace and community. This paper is based in part on the ethnographic literature on industrial workplaces and the working class communities associated with them and in part on interviews with eight steelworkers employed at Stelco in Hamilton, Ontario. All but two of these started work at Stelco in the 1970s (the

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[1] So many have helped with this study. Chief among them are the eight people who were good enough to allow us to interview them about their experience of learning (and teaching) steel at Stelco during the period on which we focussed. I would like to name them as co-authors since much of the analysis that follows comes out of theirs. Staff at United Steelworkers of America Local 1005 were enormously helpful and Stephan and I are particularly appreciative of the support of Frank Smith, president, and Bob Sutton, editor of *Steelworks* without whose help we could not have gone forward with our work. We are also very appreciative of Frances Tolnai's transcriptive work which produced from often less than perfect tape recordings remarkably lucid and accurate transcriptions. David Livingstone's support and discussions—as well as access to his library— have also been much appreciated.

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exceptions started in the late 1960s); all are still employed at the plant though three are also on the staff of Local 1005 of the United Steelworkers. Stephan Dobson and I talked in an unstructured fashion with these people about how they learned their jobs at various points in their working lives in the plant and about from whom and how they acquired the manual/mechanical skills that they brought into their work in the plant. The working lives of those we interviewed have seen the local experience of the radical restructuring of the steel industry in North America that was taking place during the 1980s and early 1990s. What these people had to tell us has been our major resource and we have tried to draw on these interviews in such a way that their voices are heard and are not dominated by ours. Indeed, much that is written here is in a sense 'dictated' by what we learned from the interviews.[2]

I have also drawn on the ethnographic literature on working class communities and on the industrial workplace. Learning and training are not generally a focus in this literature so that material on these topics was on the whole sparse and mostly provided indirectly. Nonetheless there has been much to learn from these sources and it is introduced here as it becomes relevant. In addition, I have made use of some of the research that George Smith and I did in the late 1980s on issues of training in plastics processing industry in the 1980s.

Our interest in the interview part of the work was in learning processes and on being able to describe these as people experienced them. Of course, our numbers are small and we make no claims to a representative sample. Rather our focus has been on what we can learn about processes of learning and of transmitting what is learned in the plant outside formalized learning in classrooms. We talked with our respondents at length, sometimes on more than one occasion. There were people who had trained as apprentices, technicians and production workers. We were interested primarily in how people learned their jobs and particularly in experiential learning (the topic of the third section of this monograph). The individuated formulations of skill as it is recognized in personnel files or as qualifications is a barrier to learning more about the social organization within which skills have been learned and transmitted within the working class.

Looking back through the prism of our transcribed interviews, it seems that our questions and the responses we got focussed on the 'how' of non-formal learning rather than the *what*. What would be understood as 'learning' was defined by those we interviewed. We asked questions, mostly focussed on how they learned. We did not work from a formalized definition, restricting questions to its parameters. We took 'learning' in its everyday senses, taking advantage of the ordinary way in which everyday terms become expanded and specified in the

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[2] Quotes from the interviews have been edited modestly: Interviewer interjections, "yeah's" and the like have been omitted; some passages, mostly brief, have been omitted to create greater continuity in the account of a particular topic. This would not normally be good reporting practice since responses are responses to the researchers' questions and hence shaped in part by the researchers. Here however the researchers are fundamentally so naive and ignorant that the responder's knowledge clearly dominates. Omissions are marked as customary with an ellipsis. In editing, I have kept in mind the principle of foregrounding what those we talked to had to tell.

course of talk. Focussing on the 'how' of learning allowed those with whom we talked, to take it up as active and as something they did rather than as an abstract process. It did not become defined on analogy with formalized learning that differentiates a period of learning from its termination in a competence, generally represented in formal educational settings by a credential. Though that kind of formalized structure was represented in some accounts, the people we talked to described learning as taking place in many settings and as part of their everyday working lives. In a sense asking about learning focussed attention on what could count as learning in the everyday work setting.

A good deal is known about the formal processes of storing and transmitting skills and very little about the social *forms* that organize the storing and transmitting of skills defined as non-formal because they have not been 'recognized' by formal educational processes and do not result, for those who exercise them, in definite qualifications. The topic of this monograph is precisely that of the social organization storing and transmitting non-formal skills in the community and in the workplace and of the significance of the industrial restructuring of the 1980s and 1990s for that social organization.

Ethnographic and historical studies of workplace and working-class communities give clues to the character of relations that reproduced skills among working class men across generations. From these it is possible to learn much about the largely hidden history of this aspect of the social organization of the working class in North America. The interest is in identifying the traces of a past when access to workplace skills among men was largely controlled by working-class men as well as in the former dependence of industrial production on systems of storing and transmitting skills that were buried in the relations between stable working-class communities and large-scale industrial enterprises. These systems of storing and transmitting informal skills have been disrupted and virtually wiped out in processes of technological and managerial restructuring which have radically reduced the numbers of a workforce in a given industry and hence its ability to sustain a stable working class community over several generations.[3] These can, as we shall see, be traced in the lives of steelworkers that Stephan Dobson and I interviewed.

'Downsizing,' 'restructuring,' and so on refer to the contemporary reorganization of capital enterprise. New technologies and, in particular, the computer have been transforming not only the technologies of production but also technologies of management. In the latter context, new technologies have standardized procedures and introduced systems of accountability and supervision that radically reduces the agentic role of labour in large-scale manufacturing (and indeed in other sectors). Such changes are not only oriented to the reducing the cost of labour to the corporation. They are also part of a continuing project which is to subject the workplace to an

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[3] Michael Moore's movie, *Roger and Me*, showing the devastating effects on Flint, Michigan of the removal of the GM auto production refers to the multiple personal relationships of family and friends that were disrupted and destroyed. Along with the destruction of a way of life was, I suggest, a destruction of the non-formal systems of organizing and controlling the production and transmission of knowledges on which companies such as General Motors had relied for so many years.

increasingly pervasive managerial control that integrates work processes more and more intimately into the managerial and financial accounting systems that, eventually, tie the enterprise as a whole into global financial markets.

An aspect of that increased control which is of special interest here is the development of skills training technologies and managerial and corporate strategies (through such agencies as the Conference Board of Canada) aimed at breaking the workers' monopoly of nonformal skills training vested in workplace hierarchies and in the stable working class communities sustaining an industry.

While the first part of the study focuses on non-formal skills transmission in the community, the second focus is on non-formal skills in the plant, on their distinctive role, how they are learned and how they are transmitted among workers. These focuses together examine the nature of the skills resource created by workers in both community and in the industrial setting. The concern in general is with non-formal skills that have been traditionally sustained, both in the community and in the plant, by workers among themselves and hence with what is at risk in the combination of the downsizing that dismantles the great working class communities, the technological and managerial restructuring of an industry and the increasing substitution of formalized and institutionally controlled forms of training for the non-formal modes among working class men. D

The Contingent Destruction of the Worker-Controlled System of Storing and Transmitting Skills

When the issue of loss of control over skills and of the degradation of labour is examined in terms of intersecting social relations, I suggest that what comes into view is the progressive destruction of a 'system' of storing, producing, and reproducing the skills of hand, eye, and brain which, first, was lodged in the intersection of industrial enterprise and working class community, and second, was largely organized and reproduced by working class men outside the formal educational processes instituted by the state, and third, on which the great industrial engine of capitalism that we know as 'Fordism' depended. I do not view this line of argument and investigation as conflicting with the emphasis on skills as they are operative in the workplace and on the changing nature of controls in the workplace (Burawoy 1979). Rather, I am concerned to examine the storage and transmission of skills as a *social organization* internal to the working class in both workplace and community and how it has been undermined, if not destroyed, by the changes we call 'restructuring.' The very existence of large working class communities has been undermined by the 'flight' of industrial production to the southern United States or to Mexico (as well as offshore).

That technological innovations and other forms of restructuring aim at reducing labour costs is scarcely news. Their costs for working people's lives is another matter entirely, as succinctly stated by David Livingstone:

> The major human consequence of this cost-cutting logic in steel has been the most massive single-industry job losses in the history of capitalist manufacturing, with

> widespread disruption of the communities that had grown up around these large integrated steel plants. By 1990 the steel industries of the advanced capitalist economies had eliminated more than a million jobs and more than half their 1974 work force, with the vast majority of these reductions occurring prior to 1983.... Whether in the form of plant closures or chronic layoffs, the destructuring of the long-established wage-earning relationship in steel has meant that many workers have faced early retirement, prolonged unemployment, or the prospect of much lower paid jobs, often far afield. Their household partners have increasingly been impelled to seek generally low-paying, often temporary jobs in an attempt to reconstitute the "family wage." Young people can no longer expect to follow their fathers into secure jobs at the local steel mill. (Livingstone 1993: 19)

Intergenerational transmission and peer exchange of skills that have been integral aspects of the social relations of working class communities and the industrial settings of the past have been disrupted. This has meant as an incidental effect the destruction of the social organization reproducing skills and masculine values across generations:

> In Hamilton, as elsewhere, the new jobs in the 1980s were being furnished by small firms operating mostly in the service sector. The steel industry, while still central to the city's economy, had ceased to be a source of employment for working-class male youths graduating from the city's high schools, whose fathers, in many cases, were steelworkers.... Increasingly, steelworkers were older men nearing retirement age: the average employee at Hilton Works has now worked for Stelco for more than twenty-five years. "Global restructuring" has produced a deep generational split in the working class. (Corman *et al.* 1993: 10)

The great working-class communities of the past and the industries on which they depended and which in turn depended on them were engines reproducing manual/mechanical skills, both those that created a generalized level of manual accomplishment in the male working class, including increasingly knowledge of mechanical systems and the uses of manual tools of considerable technological sophistication. This was a culture according respect to men who excelled in skills and knowledge, both those relevant to non-workplace activities, home renovation and repair, automotive repair and reconstructions, and so on, and those produced and reproduced in the workplace. The former, I am suggesting, were foundational to the latter and created a reservoir of human capital that was certainly deployed in the interests of working class communities and individuals, but were also surely of direct and indirect—though always invisible—benefit to capital.

A second dimension of these changes is what, extrapolating from the work of Harry Braverman, can be described as a phase of class struggle in which capital in new managerial forms has been constantly and restlessly in search of more effective means of expropriating what Marx called the knowledge, judgment and will of workers, replacing them with technologies that displace the active part in production played by workers and also with managerial technologies that exercise increasingly intimate control over the production process. I want to bring into focus the social relations of skill storage and transmission at a particular historical juncture in the long struggle between capital and

labour over control of skills.

Harry Braverman's study of *Labor and Monopoly Capital* (1974) initiated a major debate focussed on his thesis of the progressive degradation of labour as a consequence of forms of 'scientific' management, coupled with technological change. One side of the debate foregrounded the technological changes that were represented as giving workers greater control over their work situation, freeing them from the constraints and stress of automated work processes (Blauner 1964; Hirschhorn 1984; Zuboff 1984). Rather than as 'degradation,' these writers saw technological change as contributing to an upgrading of workers' skills, particularly their conceptual skills. In contention with them are those who emphasized the 'deskilling' effects of the new forms of automation and new managerial strategies resulting together in an increasingly effective subordination of workers to the changing regime of accumulation (Thompson 1989; Wood 1989; Vallas and Beck 1996).

In this monograph, Braverman's account of the emergence of managerial technologies and their expropriation of worker's skills and knowledge is seen as part of a larger development. From the late nineteenth century forward, objectified and trans-local forms of organization have been emerging and expanding their scope. The ruling relations, the complex of objectified social relations that organize and regulate our lives in contemporary society, progressively absorb or displace forms of social organization that arise directly among people in local settings of their lives, displacing the perspectives and concerns of individuals. Objectification, as a locally achieved *practice*, requires individuals to subordinate individual perspectives to what can be expressed in the formalized discourses that determine not so much what individuals think as what they can speak or write of in the settings of their work.

At the turn of the century in North America and other 'developed' countries, rapid innovations were being made that have permanently transformed the way in which the social is organized at the level of the society at large (Beniger 1986). Developments in the bureaucratization of the state, familiar in sociological literature from the writings of Max Weber (1978), were accompanied by radical innovations in the management of business enterprises and, associated with the rise of corporations, a move away from the identification of business with individual owner/managers (Chandler 1977; Noble 1977; Roy 1997). The governance of cities began to be transformed from forms of patronage to bureaucratic administrations. Public schooling came to be organized through the administrative apparatus of school districts and a professional educational staff of college or university trained teachers. Generally speaking, professions came into new prominence as a method of guaranteeing training, credentials and standards of practice in the dispersed settings of professional practice (Larson 1977; Noble 1977; Collins 1979), a development of special importance in the geography of North America.

The trajectory of the ruling relations since the late nineteenth century, at least in North America, has been one that progressively expropriates locally autochthonous forms of social organization embedded in particularized relationships. In his two major studies of the emergence of what he calls 'the visible hand,' Chandler (1977) directs attention to the progressive incorporation of the local organization of economic functions and their coordination through

networks of market relations into the large-scale corporation. The unregulated processes of the market became integrated with the administration of the corporation. Problems of financing and of credit that dogged systems of exchange based on sequences of transactions among small local businesses came to be regulated under the administrative umbrella of a corporation's managerial and accounting systems. Uncertainties in sources of supplies are resolved by vertical integration with manufacturing. For example, General Motors (Sloan 1964) first expanded in a process of vertical integration of independent craft firms that were suppliers of parts in an attempt to secure a coordination of supplies with expanding production; a second kind of acquisition was of firms making automobiles occupying different market segments from General Motors, but potentially in competition with it. Similarly, the expansion of mail order retailing and of department stores appropriates and displaces the local organization of jobbers, incorporating their functions into a single administrative system (Chandler 1977).

Complementing Chandler's account is Thorstein Veblen's earlier observation of the transformation of the country town with the expansion of what he calls 'Big Business.' He describes the country town as a 'retail trading-station' in which townsmen competed for the product of farms or to sell to farmers the means of production (Veblen 1954: 144). The coming of 'Big Business' transforms this. Smaller retail and wholesale businesses are subordinated to the new large-scale forms of organizing business:

> Increased facilities of transport and communication; increased size and combination of the business concerns engaged in the wholesale trade, as packers, jobberes, warehouse-concerns handling farm products; increased resort to package-goods, brands, and trade-marks, advertised on a liberal plan which runs over the heads of the retailers; increased employment of chain-store methods and agencies; increased dependence of local bankers on the greater credit establishments of the financial centers. (Veblen 1954: 154)

"The country town," he writes, "is no longer what it once was," a local habitation in which a man might "bear his share in the control of affairs without being accountable to any master-concern 'higher up" in the hierarchy of business." (Veblen 1954: 155).

Braverman's account of how managerial technologies have displaced the forms of skills and judgment that were the property of workers is thus, I argue, to be seen as a part of a more general process of the expanding ruling relations, an expansion that has accelerated rapidly in the last twenty years or so with the advances of computer technologies and that, viewed from the perspective of a new century, can be seen as an expansion of capital's penetration of the organization of people's everyday lives, whether in the workplace or community. What we call restructuring is more than change in the technologies of production; it involves changes in the technologies of ruling or governance that go significantly beyond the industrial setting itself. Restructuring links the industrial setting to technological initiatives (originating in engineering) that integrate, in public companies, the managerial system of control of production is hooked up via the refinement of systems of accounting to the market dynamics of financial capital. At the level of production, it is not so much that skills have been 'degraded" but that new kinds of skills are called for. However, these are not skills that can be learned non-formally in the traditional pattern of transmission of which apprenticeship was the ideal type. Training functions are

progressively transferred from relationships among workers in a given plant to the local community college and to government funded or subsidized programs delivered by both private and public training institutions. In addition to apprenticeship programs, themselves increasingly involving formal learning that participates in the same technical and intellectual discourses as engineering, community colleges in Ontario provide courses for production workers tailor-made for the specific needs of companies. The transfer of knowledge, judgment and skills is not only from workers as individuals to management, but from the workplace and relationships among workers to formalized educational institutions integrated with the technical and scientific knowledge systems that directly or indirectly serve the main business of capital, namely accumulation (Noble 1984).

Increasingly today skills-training involves formal training in the class room as well as on-the-job training. Formalized learning is located in scientific and technical discourses that are standardized not just for a particular plant or region but as technical and scientific knowledge is developed and is transmitted discursively. When skills were passed on directly from individual to individual at work, traditions varied depending on the individuals through whom it was transmitted, their experience, discoveries, and abilities. By contrast, in formalized learning situations, teaching materials, such as textbooks, standardize at least the formal dimensions of skills across local settings and draw upon a scientifically generated knowledge base in engineering and the natural sciences.

These changes in the organization of skills-storage and transmission invite us to go beyond Harry Braverman's account of how the development and expansion of the managerial technologies associated with the work of Taylor have resulted in the degradation of work. He argues that as these technologies advance, they expropriate the knowledge and judgment of workers. Progressively the dimensions of skill that have been essential to industrial labour are displaced by transformations of machine technologies and the transfer of forms of cooperation from interrelations among people on the shopfloor to machines. Increasingly, computers directly integrate the coordination of industrial processes with the managerial system. The kinds of changes that have been occurring with increased rapidity in the last thirty years call for an expanded conception that goes beyond management to attend to wider transformations of the ruling relations (Smith 1999).

What has subsequently been emphasized in studies stemming from Braverman is the effect of changing and increasingly engrossing technologies of management on the deskilling of jobs and workers. Studies that focus on deskilling, however, drop an important dimension of Braverman's study. For Braverman, the degradation of work is an integral part of class struggle, not in the sense that it has come to mean, namely as a social movement, but as Marx originally conceptualized it, particularly in his account of 'so-called' primitive accumulation in the first volume of *Capital*. There, Marx describes the active role of the rising bourgeoisie in the establishing of a working class. He shows the complementary relation between owners of the means of production and those lacking them that constitutes capital as a social relation. Braverman, having described modes of control used by capitalists in the early days of industrialization in the United States, goes on to describe the interests of capital in expanding

control over workers:

> In those early efforts, the capitalists were groping toward a theory and practice of management. Having created new social relations of production, and having begun to transform the mode of production, they found themselves confronted by problems of management which were different not only in scope but also in kind from those characteristic of earlier production processes. Under the special and new relations of capitalism, which presupposed a "free labor contract," they had to extract from their employees that daily conduct which would best serve their interests, to impose their will upon their workers while operating a labor process on a voluntary contractual basis. (Braverman 1974: 67)

The major managerial innovation responding to this problem, inherent in capitalism, was that of scientific management associated in particular with the name of Frederick Winslow Taylor and developed in the late nineteenth century.

> [T]he essential element is the systematic pre-planning and pre-calculation of all elements of the labor process, which now no longer exists as a process in the imagination of the worker but only as a process in the imagination of a special management staff. Thus, if the first principle is the gathering and development of knowledge of labor processes, and the second is the concentration of this knowledge as the exclusive province of management—together with its essential converse, the absence of such knowledge among workers—then the third is the *use of this monopoly over knowledge to control each step of the labor process and its mode of execution.* (Braverman, 1974: 119)

Braverman's analysis is confined to industry, particularly manufacturing. The concept of 'ruling relations' (Smith 1999) locates these changes in a more general framework of the development of objectified forms of social organization and relations that include not only management, but also the variety of institutional forms including formal educational institutions (schools, community colleges, universities). The ruling relations are represented as a trajectory of increasing transfer of control and organization from individuals and local settings and relationships, to objectified and abstracted forms. The process is not just internal to industry. Radical changes in the educational system shifts significant dimensions of skills learning from the internal organization of industry and from relationships within the working class to formalized training in definite institutional settings. Developments in science and engineering stemming from research, changes in the professional education of engineers, reworking of government regulation of qualifications and credentials, and the redesign of courses and programmes in community colleges (Dennison 1986; Smith 1990), among others, are no less part of the transformation than the reorganization of industry and of the relations of capital itself. The conceptualization of these as part of the expanding trajectory of the ruling relations draws attention to three dimensions:

> 1. It draws attention to the coordination of people's activities in multiple local sites through social relations organized outside those local settings, connecting people and coordinating their work in modes that do not depend on particularized relationships between people.

2. It draws attention also to the progressive standardization and generalization of specific forms, procedures, criteria, technologies, knowledges and so on and so on, across such local sites.
3. And finally it draws attention to the ways in which the expanding trajectory of these relations expropriate forms of organization, knowledge and skills; that are vested in local settings, localized relationships and particular individuals (Smith 1999).

The remainder if this paper is organized as three sections: the first of these focuses on the storing and transmission of non-formal skills as these have been embedded in relationships in the working class community. Here we are concerned to trace the relational contexts in which the manual/mechanical skills that industries drawing on the manpower (and I use the term advisedly; the vast majority were men) of a given community could take for granted; the second topic is that of the changing organization of training from those forms largely under working class control (trades and crafts will not be considered here) to the involvement of community colleges directly in training for the specific needs to companies. This general institutional account; is complemented by a picture drawn from material from interviews Stephan and I did, of the changes as experienced by the Stelco workers we talked to; finally, largely invisible forms of experiential learning of which those we interviewed spoke at some length are explored. The interest here isn't just in uncovering the distinctive character of this form of learning, but also in indicating the uncertainties of its transmission among workers under the present industrial regime at Stelco.

Part II: Mechanical/Manual Skills Storage and Transmission as a Feature of the Social Organization of the Working Class Community

When it comes to the nonformal learning that was among men of working-class communities, there is little to go on in the ethnographic literature. We can get clues from ethnographies of working-class communities (Kusterer 1978; Halle 1984; Dunk 1991). In the community context, I am interested in non-formal skills that may not generally be recognized and that consist of a familiarity with certain kinds of tools and their uses (a mitre-box for example), with particular geographies and patterns of traffic, with what is inside the walls, underneath the floor, connects the gas cooker to the mains, the electric light switch to the lights, the spark plugs (in an older car) to the carburetor, the workings of transmission and clutch, and so on-- the kinds of knowledge that is prior to and presupposed in the learning of more specialized skills and in the kind of work that working-class men have traditionally undertaken and been assigned to in the industrial enterprise. Such 'familiarities' became visible as skills, for example, when women first began to take vocational courses in preparation for entering trades. I remember from the 1970s being told about finding that the shop course they participated in took for granted extensive prior experience in the names and uses of a variety of tools and practices associated with them . Similarly in the workplace, non-formal knowledges of the particular local histories and geographies of plants,

machines, and people have been maintained and transmitted in gender specific hierarchies of learning. This is knowledge that is prior to and taken for granted in knowledge at more 'visible' levels. Michael Polanyi [Polanyi, 1983 #8] uses the concept of 'tacit knowledge' to locate what people know that is not explicit, not named and not inculcated through a formalized process of instruction. He uses as an example the spelling of the railway station in Wales with the longest name. It is one thing, he says, to know how to read it. But to know that it is a name and the name of a station on the railway line is presupposed in reading it as such. It is a tacit knowledge on which knowing how to pronounce the name relies. Such knowledges are tacit. In an analogous way, being able to do a particular kind of job depends on tacit knowledges which have, at least in the past, largely been learned experientially by doing, by watching and being 'shown' by someone who knows how, and in informal relationships among people, relatives, friends, peers, or workmates, in workplace or community or household settings. This kind of learning goes on among people who do not occupy institutionalized positions designating them as responsible for transmitting formalized systems of knowledge and skill. It has gone on in working-class communities between kinfolk of senior generations and their juniors—fathers, grandfathers, and uncles teaching boys and young men, mothers, grandmothers and aunts teaching girls and young women—by tacit example, by encouraging and criticizing attempts, and occasional instruction or intervention. We do not know how wide the networks of learning extended or how young people, and, in this investigation, particularly young men, were involved.

According to David Halle (1984: 35), the non-formal skills learning of leisure hours were strikingly "sex-segregated," involving many of the married men and most of the single. LeMaster's 1975 study of a working class community describes, at least on the part of some informants, deliberate strategies on the part of men of the senior generation designed to prevent the 'feminization' of boys and young men.

> These men share the belief of the British upper class that boys should never be reared by their mothers or other women, since they will make a "goddam sissy" of him. Since these men do not have the English boarding school system to rear their sons, they have to improvise. In the past, one of their strategies was to get the boy out of school as early as possible and get him on the job with other men, but this has become increasingly difficult as the craft unions have begun to require a high school diploma for entering apprentice programs. (LeMaster 1975: 112)

His study suggests that the senior generation of that time might have consciously sought to wean boys from the influence of school, identified with feminization, stressing the importance of a toughening that would prepare a boy for what he could expect to confront in the future. Workers favoured weaning boys from school to get them away from women teachers. Here is the view of a sheet-metal workers he talked to:

> If you can't get the boy out of the school system and away from the "goddam women teachers," then the next best bet is to get him into school athletics, especially football. One man, a sheet metal workers, put it this way: "I'll say one thing for that football coach up at the high school—he makes those guys get down in the mud and go at each other. By God, that's what they need to get along in this world. (1975: 112)

Glimpses such as this suggest that Paul Willis's [Willis, 1988 #9] exclusive focus on the class dynamics of the school may miss the process of learning masculinity from a senior generation consciously concerned to discourage boys from an educational exposure that would undermine it.[4]

Some of those Stephan and I interviewed in Hamilton described learning the use of tools from their fathers. Transmission of skills with tools from father to son was described by more than one of the workers at Stelco Stephan and I talked to:

> *Steve: My dad did a lot of woodworking and construction work around the house as well, did electrical work and stuff like that. So probably by the time I was ten or twelve, if I wanted to add an electrical circuit in my bedroom to plug something in, I knew how to do that. I knew that it had to be in a box and... I had to use clamps every three feet for the wire. So when I took electrical in high school, they weren't teaching me anything I didn't already know. And a lot of that came from because my dad did that. He would also do it at my aunt's house and everywhere else where somebody asked him, you know, "Would you help me do this?" or "Would you help me to do that?"* (Steve, January 2000)

The only woman in the group of workers Stephan Dobson and I talked to at Stelco described learning skills with tools from her father:

> *Alison: ...my father, as far as tools and everything, he always allowed me to help him.. Like I could always repair my own bicycles and things like that. I didn't realize until later*

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[4] Conceptualized very differently, Arthur B. Shostak (1969) records very similar patterns of alienation among those working class youth he labels as 'rebels' and 'accomodators' in his 1969 study of 'blue-collar life' in the United States. The 'rebel' group is characterized as likely to become involved in 'delinquent' activities, but otherwise they do not seem markedly differentiated. Those who accommodate stay in school, usually in a predominantly working class high school, although they are likely to be steered into vocational courses. Their "youth culture" emphasizes

> fun and adventure; a disdain for scholarly effort; the more or less persistent involvement in "tolerated" status offenses like drinking, gambling, occasional truancy, "making out" in the sense of sexual conquest, driving cars before the appropriate age, smoking, swearing, and staying out late. (David Matza, quoted by Shostak 1969: 150)

Here and at other points in this account, a distinctive and traditional working-class culture of masculinity seems to surface. The lack of interest displayed by blue-collar youth in this group for continuing on to college even when they "possess high academic aptitude" (1969: 151) suggests that they may share the kinds of emphasis on manual rather than on 'mental' skills suggested in the quotation from LeMaster above. The same would seem to surface in Shostak's account of educational and career decisions made by the group of blue-collar youth he describes as "the achievers" who successfully make their way into college. They appear to share values that downgrade non-manual skills, both in themselves and in relation to the kinds of occupations to which they can expect to get access. Every now and again, the 'influence' of a senior generation becomes directly visible, though negatively valued, as when he writes of the "uneven and unreliable knowledge" of the labour market transmitted to blue-collar youth by "well-meaning parents, friends, and the mass media" (Shostak 1969: 153).

> *on that that was unusual for a girl at that time, to be able to do that, right? But he was always, like you know, if he was working on the car, he would always ask me and I'd help out or that kind of thing.* (Alison, interview 1, March 1999)

Notice that Alison attends to how her learning experience differed from those of other girls in the community. The gendered transmission of skills appeared at a number of points in the interviews we did. In this example, the topic is not gender; rather gender emerges in the interview process itself.

Learning non-formal skills at home was associated by many with 'fooling around' with automobiles. This is a distinctly gendered leisure activity. In describing how he goes about working with an apprentice technician, Steve talks with pleasure about showing him the way he liked to work:

> *Steve: Occasionally we would take an instrument completely apart, and re-paint the case and clean each and every piece, and I enjoyed showing him the way that I like to work by rolling out a piece of paper towel and cleaning each and every part, polishing it up, and putting it in order, and then going back and reassembling it all. So that part—*
> *Dorothy: You'd arrange it in like the assembly order, the order in which— Yeah.*
> *Steve: Yeah. But I always liked to have the idea that you put it on a piece of paper towel, you'd roll out three or four pieces of paper towel, and each and every piece, when you put it on the paper towel, there was no rust on it, it was clean and shiny like a brand new part.*
> *Stephan: You probably did that with automobiles.*
> *Steve: Yeah.*
> *Stephan: It's an automobile technique.*
> *Dorothy: Oh yeah?*

Stephan and Steve shared a knowledge of 'automobile technique' that I did not share. Various mechanical devices—automobiles, motorcycles, dune buggies, model boats—referred to in our interviews suggest the existence of a mechanical culture in the community. Here's Steve again:

> *Steve: When I was in Grade 11, I bought a Hillman car and my buddy had a Morris Minor and we used to go to the car races every Friday and Saturday. So we were always under the hood of somebody's car.* (Steve, January 2000)

Alison can be seen to participate in this culture when she describes being able to share problems she encounters at work with her husband:

> *Alison: ...my husband used to be, he used to work in a garage. I used his knowledge that way mechanically when I started there, very much so. So I used to go home and go "I've got this problem" and then I would explain it to him and he would say "Well, you could try this," you know.*

Learning 'automobile technique' seemed, in our interviews, to involve peers rather than relationships between father and son or daughter. Bill, for example, had no special interest in cars, but he describes helping friends out with theirs or hanging around with friends who made dune buggies:

> *I: In your 20s, yeah so you were in the mill. Would you sometimes help friends out when their machines needed fixing, their cars, or their motorcycles or whatever or would you*

...?

Bill: Whenever somebody asked me, I 'd help them with something. I'd probably tell them if I didn't know anything about it, well, I don't really know anything about it but I'll do what I can.

I: Yeah, because like one of the things that I sometimes see, you know, that... a kid will have a car or a motorcycle and there may be a couple of guys kind of hanging around, you know, kind of talking about it.

Bill: If that was your interest, if cars were your interest, like people hanging around and gravitate towards the people who have same interest as you and discuss cars and engines and whatever, and help each working on them. I knew a couple of guys that built dune buggies. I used to hang around with them quite a bit, like for hours, just taking them apart and putting them back together again and welding a frame together. (Bill, interview 1, April 1999)

Bill had rebuilt a carburetor just because he'd never done it before: "So I just bought a kit, a carburetor rebuild kit, took everything apart, tried to put it back together and get it to run" (Bill, interview 2, June 1999). Other steelworkers we interviewed had similar interests in vehicles. George has an antique car and belongs to a car club that includes others working at Stelco; (George, September 1999); Steve, in addition to his interest in cars, raced motorcycles in his youth. And here is Jim's account of his involvement with cars:

I: Okay. So your cars, you talked about, one of the first things you did as soon as you were earning some decent money was buy two cars. Two cars. Did you fix them yourself?

Jim: No, I bought a— I did, I fixed part of it. I bought a '67 Mustang, I've always liked the Mustang GT. Had a '67 and that was going to be my cruise car. And then I was going to buy, I bought a junker to go back and forth to Stelco. So I bought two cars.

I: And did you do the mechanical work on them yourself?

Jim: No. My brother is into cars [I: Is he?] Yeah. My brother plays with cars. [I: Older? Younger?] Younger. He likes playing with the cars. And a friend of mine who works at Stelco, we all had Mustangs, six of us all had Mustangs. So we all had Mustangs, and we all tried to outdo each other with our Mustangs and stuff like that. But my brother and my friend from Stelco were the guys that built my car. Built my 289. I mean, I paid them to do it and stuff like that, I bought the parts. My brother didn't charge me but this guy over here, yeah, he did. He does, the guy at work builds engines and everything. He's smart. (Jim, September1999)

George thought that his experience of working with cars made it easier for him to learn jobs at Stelco:

I think when you're mechanically inclined, it makes that type of stuff come easier to you. It does. And you're not intimidated by it. (George, September 1999)

A common ground in a mechanically oriented community culture is evident in Steve's story of how two of his friends got jobs at Stelco:

Interestingly enough, one of my closest friends—they had a bus come down from West Hill High School and took most of the electronics class during what was the Easter break then

> *. . . and showed us movies, gave us demonstrations of what their electrical maintenance programme. A close friend of mine, there was two of them, they decided "no, we're not interested in the electrical maintenance program, decided we're going to sneak out for a cigarette." And they were going out the door for a cigarette and they ran into somebody from Utilities. . . who was the training supervisor for instrument repair, which they were interested in. He said "Where are you guys going?" they said "We're not interested in this program, so we're going to go for a cigarette."He said "Well, come on with me, you can smoke in my office." They talked about model boats for an hour, and they were both offered jobs in instruments.* [laughter] (Steve, January 2000)

Presumably the instrument-repair training supervisor could recognize from the discussion of their shared interests the kinds of mechanical abilities and background these young men would bring to their training. Analogously, Alison is able to draw on the same common ground in a mechanically-oriented community culture when she consults with her husband about problems at work. As we saw, though his skills are primarily in wood working, he had earlier experience as an automechanic.

In the course of talking with Bill, I asked him whether he thought that the skills he was learning building a carburetor or hanging around with guys constructing a dune buggy helped in the work he does now. He replied:

> *I think the more you play with something you learn how to think or you develop... problem-solving skills. And they can apply to all kinds of things. Just the way you think. You notice a lot of people don't want to think at all; they'll take something instead of trying to fix it themselves, [instead of] taking a few minutes and learn it yourself. I'll take something apart and—What I did when I first started this finisher's job was to [take it] completely apart, see. Just saw how it worked, you know, put it back together. "Okay, now I know how it works."* (Bill, April 1999)

The manual/mechanical culture among the men of the working class community also contributed directly to the community's wealth. Several of those we talked to described an informal exchange of skills that enriched the local community's domestic life. The storing and transmission of skills with tools and manual skills in general, whether among women or men, have enriched the working class communities, particularly since the success of struggles to limit the working day has meant that substantial time is available for use in and around the home.

> Whenever possible they avoid the market place, especially when it comes to constructing homes, refinishing interiors, making car and small equipment repairs, and soon. There is a flourishing "informal" labour exchange between individuals with different skills and different kinds of equipment. (Dunk 1991: 146-7)

Jim is particularly aware of the value of the varieties of complementary skills available in his group of friends:

> *Like me, I was more into the physical. I'm not afraid to do any lifting or shovelling or moving people or stuff like that. And like some of my friends were opposite, they loved the mechanical end of it, the intellectual end of it, eh. We all... did our own thing, but I mean like we all did everything, helped every—Like me, like when it came to moving each other,*

> *helping moving the house, we all were there for each other and stuff like that. So I mean, it's funny how we're all different ways, but we all are so close. But it's nice to help out each other. Like I'd do anything for them, and they would do that [for me].* (Jim, September 1999)

Jim, who doesn't think of himself as particularly skilled with tools, built his own basement with the help of a friend and his father:

> *Jim: ...I built my basement. Yes, I did, with a friend. I used a jackhammer. He helped me do my bathroom. I did the physical work, he put the—I dig the hole, he put the pipe in. I do all the physical work and he did all the, he knew how to— My dad helped too, when I did my bathroom, but he did like the hook-up of the toilet, and the shower, and the sink and everything. But the manual work, it's me.* (Idem)

Andy who works as an electrician at Stelco described informal exchanges among neighbours in the community he lives:

> *Andy: Yes, I'm an electrician and I'm able to wire homes and I have done various homes in this subdivision [I: Yeah, really?] and from the outset. And of course, then the problem [comes up] in life, that the circuit does not work, the light does not work, why? Then you have to go down and figure out why....*
>
> *I: Yeah. So would you do that, would people pay you? Would you do it for free, or do they sometimes do things for you?*
>
> *Andy: Well, usually people want to, I will do something for them, they will do something back, pay me back some other way. So this guy could be a mechanic and of course, my car needs to be tuned up and instead of paying me, he could just tune up my car.* (Andy, May 1999)

Resources such as tools may be shared. Jim told me that he doesn't need to keep a lot of tools because he can borrow tools from others:

> *Jim: ...I haven't a lot of tools. My dad has tools so if I have to borrow anything I can borrow— Or my friend Al, like my good friend, he's got everything, every tool you need, he's got. He's got a wall like this [gestures spreading his arms], he's got all the toys. Mind, him and his wife make good money, and that's his hobby. He loves tools and everything. Like he's not afraid to try anything. So any time I need any, like he's an electrician by trade, but he's a handy man too. So I mean, I got people that anything I need to do. Like, I'll help them, I'll rip everything apart and dig it out, and I'll watch him and hand him the tools he wants. But I've never really had to do a lot of fixing little gadgets and stuff like that.* (Jim, September 1999)

Jim's friends or family with the skills he needs to supplement his own are a major resource.

Though these descriptions are only sketchy, they tap into a hidden cultural life among men in working class communities[5] that represents a real source of wealth outside the economic

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[5] Of course, an analogous investigation could be made of the ways in which such non-formal skills are stored and transmitted among women.

relations strictly defined in terms of the interchange of money and commodities. It is a form of human or capital that is generated within the working class community itself and is built into and gives substance to relationships among neighbours, friends and kin. Though it contributes wealth of various kinds to the community, it does not, as it should according to 'human capital' theory, translate directly into workers' earnings, even though it contributes to the industries that have relied on and continue to take it for granted.

We do not know what happens when the processes of restructuring and, in some instances, of de-industrialization, undermine the economic bases of the non-formal transmission of such skills. For sure, much of the intergenerational transmission of skills would be at least attenuated and the kinds of local relationships of support and exchange of skills contributing to the local standard of living would also be disrupted, relying as they clearly did in the examples cited here on a pre-existing texture of relationships, some of them originating in the community and others in an intersection of workplace and community. Further the gains in leisure time that were made by workers' struggles to limit the working day are being eroded by the overall restructuring of industry and, along with that, the increased reliance by workers on multiple part-time employment.

Part III: The Displacement of Worker Controlled Skills Training

George Smith's and my field studies of skills training in the Ontario plastics industry in the 1980s provided us with several accounts of manufacturing plants where skills training was exclusively worker to worker and on the shopfloor (Smith 1988). Plastics was then and still is a relatively new industry. In many companies, the knowledge stored in the workforce and even in management were largely a product of experiential learning passed on by precept and example and learned hands-on. The following account of the Compton Company[6] provides an almost pure example of a plant in which training and advancement were organized in this way, providing a model against which the training transformations that accompany restructuring can be examined.

Most notable is the lack of disjuncture between the supervisory and managerial levels of the organization so far as knowledge of production processes at the shop floor level is concerned. The Compton Company was unusual in that management as well as supervisory staff had come up through the shop floor process of skills acquisition.

> The Compton Company produces a range of standardized products using automated and computerized machinery. All training at the Compton Company is hands-on (with the exception of short courses in health and safety). With the exception of two people in maintenance who have European training, supervisors, department heads and the general manager himself have all learned the business of plastic processing through experience and learning from others with experience. The replication of its skills-through-experience workforce is a routine aspect of how the company operates and is integrated into the supervisory hierarchy. People

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[6] This name is a pseudonym.

> come into the plant at the labouring level. Not much training is involved at this level: "In most cases it's on-the-job training for two or three days and after that any other training besides that would be to move up the ladder." Hands-on or on-the-job training is integrated into the production hierarchy.[7] (Smith, D. E. and Smith, G. A. field notes [compressed] May 1986)

On-the-job training at the Compton Company was integrated with the internal shopfloor hierarchy. A lead hand or foreman trained the 'labour-type people' as they are hired. Training for production workers was exclusively on-the-job and by demonstration.

> *[The foreman] just shows him. In most cases he shows him. We have internal books with specifications—our own company specification for the different products. Some time is spent in that. Basically most of the training is done right on the floor where they actually see what he's talking about.* (Smith, D. E. and Smith, G. A., interview, Compton Company, May 1986)

Training involved in moving up the ladder is initiated by the foreman of a shift:

> *A lot of the shifts the foreman will kind of take somebody in hand and advance them." There is also a foreman who specializes in training, going from shift to shift working "with these people that seem to show an eagerness to learn and advance. He spends most of his time with them, showing them different jobs.* (Idem)

The foremen themselves had learned their skills on the job. They were, in the view of the personnel manager we interviewed, knowledgeable but, as he phrased it, they had no 'theoretical' knowledge of plastics processing. Foremen themselves were recruited internally.

> *We hire a few people from outside [who have had previous experience working in plastics].... but most of the rest of the people we have now are being trained on the premises by ourselves. We haven't found a place where you can go and hire a foreman that could come in and work in our plant. [It takes] a lot of development to learn the process. There just doesn't seem to be any training facility that we're aware of.* (idem)

Training in and advancement in set-up and quality control departments also drew on the pool of plant-trained people. The Senior Set-Up Man who ran the Set-Up Department and had "probably been doin' it for twenty years," trained the others. Most of the people in Quality Control came from production. The manager we interviewed described the selection procedure:

> *the Quality Control people go around and they talk to all these operators that operate the machine and they see that, "O yeah, this chap knows how to measure the plate. And he's very interested in quality," and this and that. So suppose you have a requirement, that's the first place we try.* (Idem)
>
> Thus in the Compton Company the entire cycle of learning, including evaluation of

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[7] The personnel manager of another company viewed this as a general feature of the plastics processing industry: it "has that 'promotability' from inside, from the plant floor, whether you be a material handler or what have you. And then again to trouble-shoot machines and start learning—a lot of that was just the same."

performance (apart from the monitoring of performance through productivity) was internal to the shop-floor and among workers. The company relied for the reproduction of skills on the experiential learning of workers on the shopfloor. Foremen have learned experientially and from others before them the know-how they deploy in supervision and in training. They selected who to assign to more senior workers for training; they allocated workers to jobs in which more advanced skills could be acquired. They selected men to act as lead-hands. Advancement into jobs requiring more skills and earning more was entirely through men who had learned the work from others like themselves and experientially. The processes of transmission and storage of skills was internal to the shopfloor and management played no direct part in it.

In the plant described by Michael Burawoy (1979), learning the skills of a turret lathe operator (a good deal more demanding than anything at the plastics moulding plant referred to above) was also internal to the shopfloor. Skills were the basis of nonformal hierarchies among workers. At the Compton Company plastics processing was automated in such a way that production could not be identified with particular individuals, such differentials in skills and non-formal status would not have been so marked. At the plant described by Burawoy (1979), training other workers was a cost in lost production to the worker who did the training. Hence workers who trained others received modest compensation for lost time on the lathe.

> The most frequent arrangement was for operators to break in new employees and to receive setup-man pay (the highest pay scale) for the period if they did not make out after adding the new employee's pieces to their own. In other arrangements, those breaking in were to receive a fixed number of hours, say four, at setup-man pay. But training is still the subject of bargaining and negotiation between operator and foreman. Part of the reason for this lies in the ambiguity of the trainer's obligations to the trainee. As the shop euphemism puts it, one doesn't have to "show everything" to the new employee. (Burawoy 1979:102)

Though accountable to management, it is clear that management could not exercise direct control over the process by which skills were transmitted from more experienced workers to trainees. Experienced workers maintained the value of their specialized knowledges and upheld the 'natural' monopoly that the course of learning experientially creates, fending off potential competitors and consolidating the value of a knowledge appropriated by particular individuals.

Internal hierarchies among workers were organized to a significant extent around skills. Skills, know-how, were 'owned' by the more experienced; it gave them advantages in competitive situations over other workers; it also gave them a valuable resource that could be shared sparingly in the interests of its 'owner.' Steven Vallas and John Beck (1996) described the carefully guarded black books of older workers in the pulp and paper mills they studied, books containing notes of what workers had learned over a lifetime of smelling, tasting, watching, and testing, the state of pulp and paper on the rolls. Joy Parr describes how experienced workers protected their advantage in the skills hierarchy in a furniture factory in Southwestern Ontario in the 1920s and 1930s:

> A young man could not learn enough to run a machine merely by being present in the room and observing; older men were frugal with their knowledge, their only job security,

> willing to train only a successor who would acknowledge the teaching as a personal favour and not betray the trust by displaying precocious mastery of the work.... Karl Ruhl [one of the men Parr interviewed] was candid about the process. Although he benefitted by his kin connections, he saw the highly personalized barriers to knowledge about the machines as 'one of the big faults' at Knechtel. He recalled as a tailor asking the router operator for whom he worked how to read the design drawing for their machine and being told, 'Go ask your Dad.' (Parr 1990: 170)

Skills were a source of status, whether or not the worker who possessed them was incorporated into the formalized hierarchy of lead-hand, foreman, etc. The processes of reproducing skills among workers gave rise to informal hierarchies and loyalties among workers that presented a barrier to management's ability to control the workplace.

Joy Parr describes the hierarchy of experience and skill in a furniture factory in Southwestern Ontario in the 1920s and 1930s as follows:

> Progressing through the hierarchy in the machine room was a schooling in patriarchal relations, which young men learned and later reproduced. As boys got their jobs through the interventions of male kin, so later they gained the experience and knowledge they would need to succeed to a machine of their own through their personal relationships with older men in the room. Even after Knechtel tried in the 1920s to install a scientific management regime in the plant, machine operators in practice retained the right to choose their successors. (Parr 1990: 169-70)

Her study is particularly interesting as the only one I located that described an intersection of relationships in the community with the skills hierarchy in the workplace. She comments that the "best-placed men were sons with fathers working in the room" (1990: 170) and that

> [a]mong relatives the passing on of knowledge was a legacy and in practicality a loan. Male kin kept some joint entitlement to whatever earnings the bequeathed information might command. (1990: 170)

Management, however, might lack authority where managers, unlike at the Compton Company, did not participate in the skills-based system of status. At the plant studied by Kenneth Kusterer:

> Workers had only very vague idea of the various responsibilities of these men (managers directly responsible for production in their area), and were generally convinced that [they] didn't do much of anything:
>
> > *(He) doesn't do nothing. Take it from me, he doesn't know nothing from nothing about this department....A good thing he doesn't do nothing because every time he does come in and do something, it just fucks somebody up.* (Kusterer 1978: 39-40)

Workers under older industrial regimes maintained considerable control over who learned and what they learned and over knowledge of the work and technical processes of production. Shopfloor social organization of this kind would have been relatively impenetrable to anyone who had not themselves been part of it.

Wallace Clement's study of hardrock mining records how foremen and management used

competition in attempts to undermine the hierarchies and loyalties among workers that the miners' monopoly of skills training ability gave rise to:

> The use of existing mining crews to teach novices the necessary skills—because they certainly do not learn them in one week's class—as a disruptive effect on the crews themselves. A Thompson miner commented: "We've got to train these guys. When a new guy gets in the stope you have to take your time to train him. It costs us money. You train somebody and they up and leave." Not only is their bonus affected, but people are seldom allowed to work together for long periods of time. As a Sudbury miner said: "When a couple of fellows got together and they became pretty well experienced and good miners, then one would be the leader and the other the driller. Afterward the bosses would get the other fellow [the driller] to either bid on a leader's job or they would appoint him to a leader's job anyway, so they could put a couple of new men with these two fellows. As a rule, if two fellows worked together for two or three years, well, that was long. (Clement 1981:284)

Attempts of this kind to get control of skills passed from worker to worker accounts in part for the reluctance of senior workers to pass on knowledge to others. Instances of this kind were reported by more than one of those we talked to at Stelco.

The incorporation of skills into written texts of some kind was an alternative approach to the expropriation of skills. An early version of this is described by Joy Parr. The turn-of-the-century owner of a furniture factory in Southwestern Ontario she describes sought to undermine "the craft knowledge and craft autonomy his father had honoured" (Parr 1990: 134):

> J. S. Knechtel wanted craft knowledge sceptically scrutinized and scientifically systematized, what worthy remnants survived the test secured in the 'hands and handbooks' of managers and engineers. (1990: 134)

This is an early example of a systematic project of expropriating the workplace-developed skills of workers through the development of technical methods of recording their how-to knowledge and making it available to engineers and managers. Such attempts have accelerated rapidly in the last forty years and have become increasingly sophisticated. Both capital and state have been at work in the development of textual and technological (Noble 1984) devices enabling management to appropriate and control the skills and experience of workers acquired on the job and to take over and displace the skills training functions formerly internal to intergenerational and peer relationships among working-class men.

In 1973 a Task Force on Industrial Training set up by the Manpower Training Branch of Ontario's Ministry of Colleges and Universities recommended 'modular training' as a means of meeting training needs identified by 'industry:'

> In the 1950s and early 1960s changing labour market conditions together with public opinion caused the nature of the industrial manpower training problems facing Ontario to be altered greatly. During the late fifties public pressure was placed on government to support training-in-industry in addition to the traditional regulated apprenticeship. It was felt that apprenticeship did not adequately meet industry's needs, particularly in manufacturing, and that it was not appropriate for retaining, upgrading, and skill

> maintenance programs. Systems of industrial training less rigid than those typically available under apprenticeship legislation were required. Concern was focused on the way in which industrial training had been organized around specific occupations rather than in relation to actual functions fo workers on the job. It was argued that workers often became locked into specific occupations and were unable, because of the specialization of their training, to adapt to differences in skill requirements resulting from technological change. (Ontario Ministry of Colleges and Universities 1973: 174)

The introduction of modular methods of analyzing skills and training objectives was aimed at securing managerial control over precisely those processes of skills acquisition that had been controlled largely by workers on the shopfloor or down the mine. It was the Canadian Manufacturers Association that was pushing for the introduction of a modular approach to skills training (Ontario 1963).

In the early 1980s, the government of Ontario in conjunction with the representatives of the plastics processing industry were making use of a procedure that involved working with a group of workers in the industry to construct detailed explications of the steps involved in the performance of given tasks. These explications could then be used as the training objectives of formally designed training programs. The program was instituted because the expanding industry was experiencing a shortage of skilled/experienced operatives (the plastic industry lacked the continuities of traditional working-class skills available to other industries). The then-Ministry of Skills Development was called on to develop systematically formulated modules specifying in detail the tasks making up the skills required for a given job or position and within each task, the steps needed to complete it. George Smith and I were observers of the process. The procedure was one that brought together a group of experienced workers and, under the guidance of a community college instructor familiar with the technique, explicated their own, largely tacit knowledge, in the formalized task descriptions required by the Designing a Curriculum (DACUM) method; each job was broken down into a set of tasks and then the sequential steps involved in each task were described. This made it possible to isolate a particular task for training or to break down a whole job into its component parts which could be reassigned. Analysis of tasks for this kind could then be used to set up training modules, with performance objectives already defined by the specification of what was involved in each task.

What George and I were observing was a transfer of the non-formal knowledges stored and transmitted among workers on the shopfloor of plastics processing companies into a textual system that was controlled by government educational institutions and/or directly or indirectly by corporations in the business of plastics processing. In the ongoing efforts of capital to reduce the labour-cost component of production, the problem of production's dependence on skills reproduced outside the formal educational and training system and controlled by workers themselves has had two solutions: the technological transformations which reduce radically the dependence of the production process on workers' non-formal skills (Vallas and Beck 1996), and the generally less well understood development of 'technologies' enabling the extraction of non-formal skills and knowledge-bases in the working class and their incorporation into formalized training processes.

Some twenty years ago I was witness (on the union side) at the hearing of a grievance brought by Mine Mill workers against Falconbridge Mines. The issue was control of access to the position of Repair Crew Helper. According to the contract, access to this position was through bidding on the basis of seniority. The position had been traditionally one to which older men, no longer up to the physical demands of drilling and shiftwork, could bring their extensive experientially based knowledge of the mine, its people, and its workings. The issue being arbitrated at the hearing was the company's introduction of a test as a condition of access. A miner had bid for the job, but had been turned down because he failed the test. He was, incidentally, French-speaking, and the language of the test was English (this was made an issue at the hearings).

In the course of the arbitration hearing, It became clear that the company was not concerned about the qualifications of this particular candidate for the position. Rather, they had been concerned more generally with establishing the right to substitute formalized tests for seniority as a criterion for the position. In the motel room where we were staying in in Sudbury,we talked with a Falconbridge worker who was one of the witnesses brought by the union. He was ambivalent about the change. The introduction of a formalized test would diminish the union's control over access to this class of positions. On the other hand, foremen were members of the working class community. Because of their power in the mine to assign people to jobs, they had to be courted, with gifts of game killed in hunting or bottles of spirits given at Thanksgiving and Christmas. If you wanted to get or keep a good job, you had to be in with the foremen. Under the new system, the arbitrary power of the foremen would be gone. Formalized tests were a means through which control of the internal labour market of the mine in which the foremen had traditionally played a major part would pass to management, to be regulated technically. The insertion of a formal, textual process meant bypassing the foreman, and hence bypassing the non-formal reciprocities between foremen and workers who belonged to the same local community. Management wanted selection procedures wholly controlled by management and regulated in ways fully accountable within its bureaucratic regime and system of accounting. The issue is more than one of management control; it is also one of the articulation of controls into an overall system of technical managerial organization. For a period some ten years earlier, Wallace Clement has described the introduction of similar managerial technologies at Inco:

> In 1970 Inco undertook a pilot experiment in "functional modular training." Called the Instrumentation Training Program, it instructed forty instrument mechanics in the maintenance of instrument control systems for use in all its automated plants. First all processes and instrument equipment had to be surveyed and modules designed to teach the mechanics how to test and repair the equipment. The fact that this was necessary reflects the increased use of instrumentation in Inco surface operations. Traditionally the training for this work was a four-year apprenticeship, but when new techniques were introduced at the Copper Cliff Nickel Refinery and elsewhere, a shorter training period had to be devised. According to a senior Inco official involved in implementing the system, "the increased needs were imposed by new technology; traditional training couldn't respond." The use of the modular

> system shortened the qualification time from four to two years, obviously an advantage to the company. This modular training programme is a registered trade in Ontario, but it is a non-regulated trade, which means that the government does not supervise the course content. This is different from the apprenticeship program, where the government specifies the content and provides a broader training package. Here was the basis for Inco's objection to apprenticeships: they contained much training not needed for specific work at Inco plants. Management wanted something tailormade. [Clement 1981: 286-7]

Not only was the time taken to train shortened, it could also be taken out of the hands of trades, out of the jurisdiction of government, and incorporated into the corporation's managerial regime. It is also worth pointing out that a company's interests in training for internal needs does not necessarily coincide with government's interests in the creation of a skilled labour force.

Modular treatment of skills enables the shopfloor knowledge of workers to be analyzed as detailed sequences that can be produced as units of formalized training. Course units could be tailored to the specific requirements of the company. The evolution of internal hierarchies among workers in the plant is bypassed; the 'surplus' of skills and experience embodied in older workers could be resolved into standardized and reproduceable training units; technological changes could be prepared for by designing appropriate modules; the internal labour market of plant or corporation could be fully regulated by using formalized tests and formalized training objectives and products. In one of the plastics processing plants George Smith and I visited -- the rump of a much larger complex, originally manufacturing tires, which had been translated to the southern United States—the personnel manager complained to us about senior workers who refused to participate in an effort to draw on their knowledge in the making of training modules for the parent company, headquartered in Akron, Ohio. It was clear that the company's interests were not in controlling the skills resources of this small plastic processing plant, but in being able to transfer skills that had been created and reproduced among workers in the larger manufacturing plant into a form that could be reproduced within the corporation at large.

Major technological changes were introduced into the steel industry in Ontario starting in the 1980s and accelerating in the 1990s. Changes in approaches to training were already apparent during the 1970s. In particular, Stelco began to get out of the business of training internally for which it had formerly Stelco been renowned. In a sense, Stelco had been training for the industry in general. This, of course, was costly and was gradually phased out during the period covered by the interviews that Stephan and I did.

Changes in industry were complemented by government initiatives to create a labour force that could sustain both technological and managerial aspects of restructuring. In the 1980s, restructuring confronted the federal and provincial governments with the need to reshape the labour force in order to respond to different requirements.: In 1985, George Smith and I interviewed a federal government official who, in providing us with a rationale for government policies, cited Peter Drucker as an authority

> *[Drucker] makes some very distressing statements about the fortunes of any country's industry and he goes on to say that an industry that fails to sacrifice blue collar*

> *employment in favor of higher skilled training for a new manufacturing environment will not only lose those blue collar jobs they weren't prepared to sacrifice but they will lose other employment as well.* (Fieldnotes, Smith and Smith 1985)

Both federally and provincially, government funds became available to support the training needs of industry. Community colleges began to redesign their classic focus on training in skilled trades and crafts and began to find ways of responding to the requirements of the local skilled labour market and to the specific needs of industries (Smith, D. E. and Smith, G. A. 1990). Mohawk Community College, which serves the Hamilton area, has changed its training programs significantly over the past twenty years. There have been curriculum changes in apprenticeship and technician programs to keep up with the rapidly changing technologies of the period. In the area of engineering technology, the major change, however, has been the introduction of courses tailored to the Hamilton big steel companies such as Stelco and Dofasco (McCoy 1999). Though courses may be designed to add up to government certification, they have been tailored to the specific needs of the companies and have been taught by instructors from the companies whose pay is covered by the provincial government. Some courses are designed according to task analyses of the kind described above to meet very specific training needs.

Learning Steel at Stelco

The work life experience of those we talked to spanned a period of twenty-five years or more. Their experience of learning and of teaching on-the-job was part of those process of change described in the previous section as well as of major technological changes in steel manufascture. Those we talked to had, with one exception, started at Stelco in the 1970s. The exception started in the late 1960s. Accounts of the earlier experience of learning showed considerably greater reliance on the transmission of skills and experience among workers than later accounts. Later experiences of learning the job, among those we talked to, were, of course, of building upon a considerable depth of experience even if they were moved to a new job. However, for later periods, we also have accounts of how those we talked to went about training or otherwise passing on their experientially acquired knowledge to others.

For the earlier period, before the restructuring that began in the late 1970s and accelerated through the 1980s and early 1990s, those we talked to described for us three or four different types of training settings, depending on the type of job. The job Jim started with called for minimal training. It amounted to scarcely more than being shown where to work and told what to do:

> *I: But how did you learn the job?*
> *Jim: Well, I first started off as a labourer. So labour, we just did heavy lifting, sweeping, painting, you know, cleaning rubble, moving things over here where they need them. It was just dirty jobs. Like... shovelling grease up and everything else. That stuff. They used to have a gang leader, he'd go down there and he'd show you what to do, pick up this, pick up the bands and throw it here. So it wasn't really anything that was hard to learn, from being a labourer.* (Jim, September 1999)

Later he worked in a furnace:

there was four or five of us, we all worked together. It was scary going in there when I first started. Believe me, it's like, you go inside a furnace and you're sitting there drilling all the slags, okay? (Jim, September 1999)

Bill started in a production department in which there were a number of distinct processes:

They used to do a whole bunch of–in our department we had maybe six or seven different processes. I can't really say they were related. We had a straightening machine. The coils came from the rod mill. We had a machine that took scale off steel and put an anti-rust agent on it. The bars came from the bar mill. The washer department—that was all just scrap steel. We stored a lot of reinforcing bar for other companies that come from the bar mill again—we'd store it for the customer until they needed it and then it was gone.... there used to be a spike mill down beside [inaudible].... It's not like you get a bar billet come in the door and then go out the other door and there's coils and everything in between is connected. It wasn't like that. (Bill, interview 1, April 1999)

Bill describes learning as a helper by doing work that complemented the operator's:

I: ... you started in the mill in Stelco, and you said that you started out as a helper.... Could you describe, like, what it is a helper would be doing? How would you be learning?
Bill: Well, on different machines it would be a two-man job, so you'd have an operator and a helper. Well, when you just start out you'd be the helper, so you'd just assist the operator.
I: So what would...?
Bill: If you were on... there's a shear there that cut plate... there'd be pieces of pipe maybe the size of this tape or bigger and different widths for each... each washer machine was [a] different size. Like one was 250 ton per square inch that'd punch out washers, the other one was 60 tons. So they were different sizes. So on a shear you would cut plate down the width for each individual machine.... So the operator would be in charge of size and getting the steel and making sure he had the right gauge and whatnot and the helper he'd just help with the sheets, putting them in the machine and then after that bundle was cut he'd hook it up to the crane and the crane would take it away and... that's all you'd do or if you were working on, say, this 250 ton press again you'd just assist the operator. He's in charge. (Bill, interview 1, April 1999)

Bill shows us in this account a form of learning which is embedded in a coordinated work organization. It's in fact a tripartite organization: operator, machine, and helper. The helper is not doing the same work as the operator. He's learning the operator's job by doing; its reciprocal, feeding the machine operated by the operator and dealing with its product.. But– if he's Bill -- he's also watching the operator:

Bill: Well, you're with the person all the time, you're seeing what they're doing, you're—sometimes he would explain what he was doing and why, but just being around... You might be stuck on a particular job for months, so after that period of time you learn pretty well everything the operator knows. (Bill, interview 1, April 1999)

Alison trained as a serviceman in an operator-helper relationship. Though the organization of the work was very different from either Jim's or Bill's, she too participated in doing the work. She

was learning on the job:

> *Alison: What they start you off as is they have a three month probationary period and you're what they call a labour trainee. And then you were assigned to somebody and they would teach you a little bit about the job and they would give you basic things to do, very simple things to do. And that's just so that they, whether or not they get to know you because they can lay you off after, before the three months is up, that type of thing. Then after that, I went to what they call job Class 9, which is a Serviceman and a Serviceman is like the helper of an Operator and then you learn from the Operators.* (Alison, interview 2, June 1999)

The organization of training as Jim, Bill and Alison describe it still takes the same general character as that of the Compton Company in the 1980s. The newly hired work with a gang boss or with an operator and learn by doing the job or doing a job complementary to the operator.

Unlike the Compton Company and the plastics industry in general at that time, the steel industry had a long history and a developed reservoir of skills when those we talked to started work at Stelco. George's experience of training to be a crane operator shows the degree of reliance on the store of workers' skills laid down in previous work experience:

> *I: Could you tell me, like when you're talking about being trained,... were you just doing the job and learning as you go or really did they try to show you?*
> *George: hey tried to show you. You had to, well, on the safety factor, working with the cranes, they showed you the no-noes of the job, they'll say "Don't do this, don't do that." .... As far as a crane operator, being a crane operator, that's just some people are crane operators, some people aren't crane operators. So that was, you had it or you didn't have it.*
> *I: Was it because of the way in which you sort of tune into a particular kind of machine?*
> *George: Well cranes, because they're overhead cranes, the height, the perspective, you know, your depth perception, your ability to catch swings, you know, as far as using the levers, your eyes, your mind, and your hands, telling you what to do. And some people are better at it than others, some didn't qualify for the cranes, so they stayed on those jobs.*
> *I: Yeah. So how would you go from being a helper on a crane to actually operating it? Or how would you go from, how would they let you loose on the crane, as it were, when you were just...?*
> *George: There was a training period, at that time, there was a training period of six weeks. You trained, the first couple of days, you watched some operators would let you operate, the first day even, just to run the crane, to get the feel of the crane, the levers and whatever. You know, within a couple of days, you were making lifts, you know, like certain lifts you wouldn't make because they were too delicate. But they'd make you make, like unloading a truck or something like that, they'd allow you to do that. And then it was just the procedure, repetition, repetition, repetition. And you know, you either got better at it or you got worse at it, one or the other.*
> *I: Yeah. So the, when you say you were qualified, what would that mean? Was that anything in writing, did it go on the company's books?*

George: No. At the time I started, they used to have a crew that came around that they actually tested you.... Because there were certain, at that time, safety procedures as far as pulling switches, you had to do an inspection of the crane before you boarded the crane and that type of thing. They would ask you those questions, then they would ask you questions as far as lifts, like the capacity of the bale and that type of thing. And then they would actually watch you make a couple of lifts. And then they would say "Okay, you passed your crane lift" or "No, you didn't pass, you need some more time." And they would come back and test you and if you didn't get any better than that, usually they wouldn't use you up there. Then. At that time. Now it's a different thing altogether, like no, supervision just passes you. You know, they look at you and say "you can drive a crane."...

I: So... would these be people who were themselves crane operators [George: Yeah, they were] so they were actually pulled off the job?

George: No, they were a crew that... [I: That was their job?] Yes, they were specific. That was their job, to test cranes, to check cranes. They were a crane crew, you know, their job was specifically... but after that... that wasn't in place very long from when I started. After that it was up to the supervisor to check if the gentleman involved was qualified to run the crane. And in most cases, they didn't care. They qualified everybody. (George, September 1999)

Tony describes the late 1970s process of being qualified on the crane. In his account, we can see the shift away from the presumably costly maintaining of a crane crew to examine neophyte crane operators and inspect cranes.

Tony: Like the cranes, you needed to learn the job off of a qualified crane man. And a lot of time, he would sit behind you and watch you operate the frame. And then, in the end, if he felt that you were... ready, then they called in the crane foreman and he would sit up there and watch you operate, and say "yes, you're qualified" or "No, you're not. You need another month's training." (Tony, April 1999)

Steve describes for us the training of an apprentice instrument technician from his experience of starting at Stelco in the late 1960s:

Steve: I started in Stelco, October '66..., it was about a four and a half year apprenticeship.... They had the apprenticeships role strictly in the plant. We also took night school.... there was an instrument course that they sent us for at Hamilton Institute of Technology, which was the pre-Mohawk College.

I: Sorry, you're also working, are you?[Steve: Yes.] Okay we'll come back to that.

Steve: So they paid us our hourly wage to go to night school, three hours a week. I also took Math 1 and Math 2 at Mohawk, that they paid for, that wasn't really very related to the apprenticeship. But they were willing to pay, so I took two years of Math.... What we did, at that time in the sixties, there was actually about one apprentice for each technician. And we would have, in a six month period, we would start a job class 1, which was the lowest rate of pay in the plant, and we would progress one job class every six months. During the six-month period, you would have five pieces of equipment that you

would demonstrate, we called it a bench test, we'd have to demonstrate that we can repair a certain piece of equipment. In the first six months, it wasn't spelled out it had to be this five pieces, but it was five pieces out of, say, thirty. So at the end of the apprenticeship, you would have done all the bench tests.

I: So how did you learn from a technician or how did a technician teach?

Steve: We would take off in the morning. I was at that time in iron making which was the coke ovens, the blast furnace, the big boiler station. We'd be assigned a work area. First thing in the morning, we would walk through that area, check most of the recorders. Basically we'd look at them, we'd look at the ink on the pen, make sure that the pens were leaving ink on the chart, so we could see what happened during the night. If there was a controller that was not functioning properly, we would usually, if it was something that wasn't critical, we'd continue our tour, and then go for coffee, come back to that piece of equipment later and clean it and do whatever was required.

I: So was it your responsibility or the technician's responsibility to see that you covered, you know, the equipment you needed to learn for that particular period?

Steve: Basically, it was our responsibility, really. The technician, depending who they were, some people were helpful, some people would say "Oh, this is what we're going to do today." Generally, it wasn't a high work load. You know, we'd have a fair amount of time to shoot the breeze, sometimes we'd talk about cars or boats or what we were doing the night before. Other times, you'd ask them. It depends on how interested you were. Most of the guys, if you asked them questions, they'd answer them. A lot of times you might grab a manual and just read it. But it was, when you learned the most was when something was broken and you had to fix it. And lots of times it would be a mixture of yourself and the technician. If it was a temperature control, it was steam heating, it probably could be either the controller or at the valve, or if it's temperature, there would be a thermal-coupler or a temperature sensor, it would go to the controller, then to the valve. So sometimes you change the temperature element or you check it first. The technician would be turning the controller up and down, most of it worked on pneumatics, compressed air. So he would turn the controller up and down, and you'd be down at the valve watching to see how smooth the valve ran. So you'd kind of break the job up, a lot of it.

I: So in breaking the job up, you're also in a sense kind of learning how the thing is put together.

Steve: Yeah. If he's turning the controller up and down and you're watching to see if the valve is sticky, and it is, of course, then he'd go and say to him "I think the valve is sticking" and you'd switch jobs so he could see himself as well. Then if it was a sticky valve, we'd either get the pipe fitter to change it, or if it was a packing line problem or something, the two of you would repair it. (Steve, January 2000)

Training as an instrument technician was internal; qualification did not have government recognition and hence no formal status on the labour market. Though supplemented by a few night courses, training was otherwise exclusively with technicians already qualified within the

plant.

Critiques of the Traditional Training Method

It would be a mistake to idealize the earlier forms of training. Those we talked to described them as uneven. Not every operator took care to inform the person assigned to him to train; opportunities for interchange among workers was also uncertain. Here is Bill's appraisal:

> *What you learn depends on how good the guy is that teaches you. What I learn, I'm most likely going to keep for as long as I'm on that job. Majority of people are like that, once they've learned something, that's it, that's the way it's done, that's the way they'll always do it, even though it might have been taught to them wrong or incompletely or it wasn't explained to them properly, so they can reason when something goes wrong— "oh he told me that if I see this, most likely it was a problem right here." If that doesn't happen, these guys are just on the job and they'll do something wrong for as long as they're on that job. Won't do it properly or completely.* (Bill, interview 1, April 1998)

The kinds of situations that Steve described, where apprentice technicians could consult with senior men, no longer exist. But even for Steve, the training situation was somewhat haphazard and seems to have depended on the initiative of the learners. In an interview, he described the on-the-job aspect of training as uncertain. Some were helpful; others not. Responsibility for training devolved to the trainee. If he was interested, he could learn either by asking questions or by reading the manuals. From a later period, when he was a shop steward he took up with the supervisor the lackadaisical approach of some of the technicians assigned a trainee:

> *One of the new [guys] really got in trouble for reading a pocket book and sitting dozing off or whatever. And I'd say to the supervisor, "Why are you blaming him? You know, you send him to work with worker A, who you know goes for coffee, likes to have a snooze for half an hour. Why don't you send him to somebody that's going to teach him something? Don't blame the apprentice because he only does what the technician tells him."* (Steve, January 2000)

Dan is highly critical of what he calls 'grandfathering.' The traditional training practices as they were managed in the plant did not give the trainee sufficient time to gain 'proficiency.' In our interview, we had been talking about when Dan started at Stelco. He described the experience in this way:

> *Dan: It was overwhelming. It was overwhelming. And what happens is, at that time, they made the same mistake that they had made for years, as far as I was concerned, as an instructor and as a trainer. They'd give you an overview of how everything works—*
> *I: So this may be the supervisor?...*
> *Dan: The operator... He would take you around and tell you how everything works. You'd follow him around, you'd be totally overwhelmed with what was going on. And eventually you'd be given a task to do and you'd learn how to do that task. And then you'd be given another task to do and you learn how to do that task. And eventually, over the span of months and months, you would end up knowing all the tasks in there, but not at any proficient level because it was just too much. It took you quite some time. Grandfathering causes a lot of problems in trying to minimize the time for proficiency.* (Dan, November

1999)

Bill was also critical. In his view, the company failed to make sure that operators set a good standard of work for trainees. The standard seet varied with the operator. "If he's good at his job, well, there's a good chance you might be good at it" (Bill, interview 2, June 1999). Tony also described considerable variations in the kind of training operators provided.

> *I: Did you find that [operators] varied very much in how good they were at training you? Tony: The odd person, yeah, was different. There was the guy that took advantage of the trainee and says "Well, you go ahead and do what you can do. I'm going to lay down for an hour." And I had to learn the job on my own.* {Tony, April 1999)

Stories of withholding knowledge of a given process, the private black books that Vallas and Beck (1996) describe, and similar practices were not described by those we talked to. It had, we were told, existed earlier. Withholding knowledge protected the senior man on the job since, once trained, the newcomer, paid at a lower rate, could be used to replace the operator. It was to the operator's interest not to pass on his experientially acquired methods. The union's intervention had eliminated the practice of substituting the junior for the senior man on the job. Nonetheless, training was not systematized and seems to have varied with the interest and sense of responsibility of the trainer. When good practices were innovated, their perpetuation as a tradition was fragile. Occasionally we heard of the emergence of a mini-tradition in a particular work site:

> *Jim: You learned by being there, [I: By the person telling you?] telling you, then you got better [at] learning. And I used to train other guys when they got hired, that's where most of the junior people came in as hookers and that. I even stayed there, I was senior and I stayed there for a long time. They really liked me when I left there. My foreman wanted me to move up. The general foreman liked me as a hooker because I used to work. I'd clean up the area, like it made it easier for everybody else. I wasn't afraid to have the area cleaned. I had a pretty— I had it set up the way that other guy would show me, okay, the way he was, there was probably only two other guys like him—the guy that trained him, and him who trained me. Us three were the same way, our area, you had to see it to believe it. But he taught you that.*
>
> *He was a whiz kid, like I mean he was an older guy but he loved his job. And like I mean he was different than I was but I mean, you wanted to learn, you learned... we used to have a book over there and it would tell you the locations where to put all the steel and everything.... What he said [was] that they had certain areas, [where] different types of steel had to be loaded, because we had different doors and they had different sections where they had to be put, so assistant loaders would know where the steel was. We had to put it there. Different customers had different locations. So when a guy went looking for the steel to load it on a truck or a rail car, that's where they would look, in that area, to find this piece of steel.*
>
> *And back then, it wasn't hard to learn. I mean, when you got better, you didn't have to open up that book. He never opened up the book. He knew this customer was section 43, this customer like this. I'm saying to myself, "How long did it take you to learn that?" But it didn't take long, you know what I mean?..., you always carried that book.*

> *Most hookers never have to carry it, most good hookers would never have to open up that book. And like I mean, he knew that mill. And he said to me "By the time I finish training you kid, you'll know this place inside out." And it was fun. He was a nice guy, he was quiet, eh. Always ate his lunch on the job. And he was sort of the guy that wasn't too personal but that's fine. You know, me, I'm more outspoken, I like to have a guy talk. But he wasn't that way.... And he got trained by somebody else, and he trains. But then I stayed there for maybe four years. And the foreman asked me to go on this job, which was more money.... I didn't really want to go, but he says "Can you go and try and do this job?" and stuff like that, eh. Hey, my foreman was a pretty good guy, and I said "Okay, I'll go and try it."* (Jim, September1999)

The chain of skills, from Jim's whiz kid, to Jim who became a senior in the department and trained others, was broken when, after Jim left, the department was reorganized. When those who had reproduced it moved on to other jobs, there was no mechanism for transferring their knowledge to those who took over. Jim comments on the present state of the shop floor that had been so thoughtfully organized:

> *you take a look at the shop floor over there, it's a mess now. I take a look at it sometimes, "oh god."... they changed a lot of areas because they restructured. So the building is a little bit smaller, but it doesn't look like it's organized properly. And I take a look and it's "ughh". I said to the foreman, I tease him, I said "Chuck, maybe I've got to come back hooking." He says "We'd love to have you back here, Jim. We can't find half the steel." ... I had no problem, my shift, my guys liked it because they knew I'd have it organized. I wouldn't pile the— some of the new people would pile the new steel on top of old steel. [That] doubled the work. This guy taught you to make it easier and the guys would like you better. Even if I sometimes had to move a couple of piles and clean a couple of plates off. But you're trying to keep it, you know, organized. You learn that from experience.* (Jim, September 1999)

Restructuring

Restructuring does not appear in the accounts of those we talked to as a single coherent process. Some changes were largely reorganization in an ad hoc fashion, some were clearly a systematic reorganization of managerial policies; others were major technological innovations. The earlier changes reported were not dramatic. For example Bill describe a reorganization of production that reduced the variety of different products that Stelco had been producing and did away with the varieties of the work and learning situations that had been characteristic of his job when he first started at Stelco:

> *Actually, the mill at that time [when he started at Stelco], it did a lot of things. We did storage, we made washers, metal washers for nuts a bolts, they had a straightening machine for straightening coils and cutting bars in length, and another machine that cleaned scale off steel. It was a whole bunch of things in one building. And after a while, they just started getting out of certain things. The washer department, we ran on scrap steel from other departments, then that pretty well dried up for whatever reason, I don't*

really understand. Then we were using prime steel, then it became not cost effective any more, so they got rid of the washer department.... There was another machine there that used to bend bars for carrying ingots and whatnot, and that went out. (Bill, interview 2, 1999)

George works in one of the mills where machines that would now be considered 'archaic' (his term, see below) are still being operated. But no one is now being trained on these. George describes the kinds of changes that have taken place:

I: I know the changes over time, like the range of different things that were done at the Stelco plant here in Hamilton, I know some of them were cut out here and continued in Montreal or whatever it might be. Is that...?

George: Well, they shut some of the mills down, okay. But those jobs weren't there. The training methods and the expectations of my supervision in my department are a lot less than they were in the sixties and seventies. So a lot of the operators couldn't even grind these rolls any more, like the odd roles. So what they did with them, because it became sort of cost prohibitive in the sense that if they wanted them done they couldn't get them done, so they had to wait until maybe this operator came in or whatever is it, to do it. So they started shipping it out. So we don't even see that work any more.

I: I see. So it is contracted out?

George: Some of it is contracted out, some of it is like redundant, the mills aren't there any more so we don't do it. [D: Yeah. I see] So now basically all we do is flat roll products, that's all we do.

I: Was it an operation that could be computerized in any way?

George: The machines we operate are archaic compared to the modern machinery doing the same job. So most of our machines are manual machines, whereas the machines they have out there, if you bought a brand new one, I mean, there's self-loading machines, they're computerized, etc.

I: So people are still being trained to do this, now?

George: Not for a long time, only because of the cut-backs. And as I say, a lot of our future in those shops I don't think is long-term. I think eventually that will be contracted out to others, you know. I think it will, personally, that's only a personal opinion. But most of it, I think will be contracted out eventually. (George, September 1999)

More major changeds involved the introduction of new technologies, particularly forms of continuous processing. Unlike other accounts of technological restructuring (cf. Vallas and Beck 1996; Zuboff 1984), the controls were not fully mediated by computers. The kind of learning that Jim describes in the following passage is clearly very different from that characteristic of production at an earlier stage.

Jim: When we restructured the mill, I got involved in the restructuring of the mill and negotiated big money for that, and they paid Job Class 15. So I went from Job Class 7 to 15. Even though I loved the hooker's job, the money was really good there. And the weigher's job wasn't hard to do, it was mostly you just weighed the steel and marked it on a schedule. The piler was the one that had to do it but then now, the weigher did both the

piling and the weighing....

I: So when you were learning, originally, in this job or the job that led to the one you're describing, what was that learning like?

J: I sat behind, I sat right beside him and just watched what buttons— he had some buttons that went up and down, controls that moved the line backwards or frontwards. I mean, like it was just watching. (Jim, September 1999)

Some of the changes that emerged with technological changes appear in our interviews in the accounts of the way in which those we talked to described the process of training others. They now were the operators. Those they were training were not helpers. They were simply new to the job or, as in Tony's account, they were students from local colleges there for the summer. Here, from the point of view of the trainer, is Bill's description of his own training procedures around the time of the interview.

Well, I was training a student.... I was training student on a job about three weeks ago and he'd never been there before, and what I did was... it was a panel and what our particular job was putting [indecipherable] into a furnace, charging them into a furnace. Then there were panels, I forget how many, there might be, twenty, twenty-five buttons, but you'd have one part over here that brings the billets down. It's called unscrambling. You straighten them out and then you go on to a roller line and you bring them up farther and then the other part is putting them into the furnace. Now, when the guy at the other end needed some more billets, he'd push a button and this big arm would come and push them in the furnace. So what I would do was, "okay," I said "watch me!" And so for the first half-hour or hour, he was just watching me do this job and as I'm doing it I'm explaining all these buttons on the panel and what we're doing and what we're supposed to be doing. Then I said, "okay, come on over on this side," and I let him.... like, it was three separate processes we were doing... "Okay, you operate these ones... I'll take care of everything back here. You do this." So I did that for about... actually, it was only about half an hour because there wasn't much to it. Then I said, "okay, come over on this side," and it was, "now I want you to look after all this." It was a little bit trickier and I left him there for, I guess, maybe about an hour or so just doing this, and I said, "okay, now sit in the chair. Now you're looking after this part and that part; I'm going to look after this," so now he's doing two things. About an hour later, "okay, now you just do the job" and I'd just be standing there. If he got behind or if he got in any kind of trouble, I would ... I'd straighten it out for him. So by the end of the shift, he's pretty well... he's slow, but he knows what he's doing. If he makes a mistake, he more kind of likely to remember. You know, if I say, "don't do this because this is going to happen," well he's going to do it. Let him do it, it's fixed now. Now you get them out of trouble and off they go. To me that was the way to train somebody. (Bill, interview 1, April 1999)

This is clearly a very different situation than the one in which Bill originally learned. In those earlier settings, the 'helper' actively assisted, under the operator's direction, in getting the work done. He came to know it as a junior partner in a work process. Here, in Bill's description of learning in the current context, is an account of learning by watching how the operator controls a

process through pressing 'buttons' and then trying them out himself. Of course, as we shall see in the next part of the paper, there was considerably more to be learned but this did not form part of the operator's responsibilities in training the person new to the job. On this job, at least, the trainee can be allowed to make mistakes and to build experience in that way. But it's a very different situation of learning than the earlier relationship between operator and helper.

The specialized crane crew who oversaw training and inspected the cranes disappeared in the 1970s according to George—the period when, according to others we interviewed, foremen were ceasing to be promoted from within a given department but were hired in externally. Training facilities for technicians disappeared in the mid-1980s when Stelco, encouraged by the (then) Ontario Ministry of Colleges and Training and with the financial help of the Ontario government, came to rely increasingly on courses designed to their specifications by community colleges. While earlier the in-house formalized and non-formal training by steel plants created skills for the steel industry in general as well as for the provincial and national labour market for skilled labour. Progressively the costs of training for the general labour market has shifted from industry to the provincial government. The kind of training that Steve reported for the earlier period has gone.

> *I: Do they still have programs of that kind?*
> *Steve: Pretty well all the in-plant apprenticeship programmes, all the equipment, has all disappeared. Now the training room where we had instruments and we had sample processes that you could tune controllers and train people on, is all gone. There is no in-plant training.... now their goal seems to be... [to] try and hire somebody out of Mohawk College or somewhere....* (Steve, January 2000)

In Steve's account we can see the move described earlier, the shifts training from the plant to the community college, from at least a degree of control over the reproduction and transmission of skills among workers to control by state and capital.

We do not know precisely what kinds of changes in managerial technologies were being introduced into Stelco at this period. We can guess at some of the changes in how the steel industry was organized internationally, not only in terms of its participation in a global marketplace, but also in such indications as its participation in the International Organization for Standardization. The ISO is an association of a hundred and forty member countries that is aimed at the establishment of globally consistent agreements on the technical specifications and criteria for "materials, products and processes." Subscription to standards of this kind require the establishment of systematic and documented procedures for production processes. Alison describes her own involvement in documenting the procedures that she herself used in her job:

> *Alison: Like I'm involved a lot now with trying to write procedures up [D: Oh yes.] and have it written down.... And like when I'm involved in doing these procedures I'm wondering why are we locking it out? Are we locking it out for the mechanical to work on it or are we locking it out because the whole system is down? You know, like what's the whole process in locking it out? You know? Do we want to put the whole thing in it or do we just want to say "Okay, we're just taking it out of service to be worked on." That type of thing. And our procedures, like the format of them is basically we do a scope, exactly*

what you're trying to write down. And then you would do Safety Precautions, so anything involving like a process, whether it be gas hazard or, if you're pulling electrical disconnects, the proper procedure in how to do that, right. Then you also say like any reference material, right? So there might be a reference material on how the process works, how to change from one pump to the other without disrupting the flow, you know, this type of thing, right. So you have to write that all down. And then, finally, you get down to "the procedure." I mean, it's just a step by step type thing. And the way they're written down is actually pretty good because you do Step 1, "shut valve off over here," and then in the comments section, we'll say why you're shutting it all off. Step 2, you do something else and then you'd say, again, why you're doing it. (Alison, interview 2, June 1999)

Bill is cynical about the procedural manuals created to meet ISO requirements:

Bill: There is no standard training process.... I can get trained by four different people and four different people are going to tell me four different ways of doing something.

I: So there aren't procedure manuals that are associated with each stand or...?

Bill: There is now— but it wasn't Stelco generated. The ISO 9000 whatever else, they demand that you have manuals, more or less training manuals for each job whatever else. There are manuals there now... but I've never seen somebody take one out and read it. I've read a couple of them but I've never seen somebody use them. That's as close as they come to a standardized procedure on each job....

I: Did you find that these manuals reflected what you knew... what you were doing?

Bill: Well I know the guy that did them and the guy that did them— there was one guy they assigned but this was, like I said, it didn't come from inside Stelco. They thought, hey, you know, this would probably be a good idea if we standardize.... It was ISO demanded. They had to do it. That's the only reason. But I can take you down there and I can show you, you know, piles of dust on them or they're hidden under here or whatever else. It's the only reason they're there....

I: Do those manuals come out when there's an audit?

Bill: They'll dust them off.

I: They'll dust them off!

Bill: I'm serious, they'll dust them off. They'll go along and just.... you know, they might be in a drawer or underneath a desk or sometimes it's right on the floor in the corner. The guy'll take them, dust them off, put them somewhere where they can be seen. I'm not kidding you. (Bill, interview 2, June 1999)

Even though the procedural manuals are not used to standardize training or routines, their availability becomes important when there are questions about whether proper procedures have been followed. In addition to ISO requirements, the documentation of procedures was required by the Health and Safety Committee (a joint union-company committee). Alison, who is a Health and Safety rep, describes how written procedures are used in case of an accident.

Alison: That's one of the things, whenever I go to an accident investigation. Because a lot of these accidents that I do attend are not in my department, the first thing I ask is "Where is the job procedure?" And that way the company has themselves covered. If there's no

job procedure, it's like "Well, who instructed this person to do it?" (Alison, interview 1, April 1999)

The extension of these types of managerial organization into the daily life of the plant has also been associated with a marked shift from the type of organization that characterized the Compton Company described at the beginning of this section. The Compton Company provided us with a model of industrial organization in which there was no disjuncture between the knowledge and skills of the shopfloor and that of the supervisory and even managerial staff. As the managerial organization of Stelco became increasingly hooked into the ruling relations, nationally and internationally, whatever the technological requirements, there were also requirements of skills of a type that could only by learned in formal educational settings. Hence increasingly the supervisory staff are no longer recruited from the shopfloor but are hired externally and, in the contemporary setting, may even have university degrees. The disjuncture between the experiential knowledge of people gained in the course of their everyday work, both out of their experience and as they themselves improved on what they had learned, and the knowledge of the supervisory staff became marked:

Bill: In the seventies it changed, where they hired outside, unrelated to the shop. Prior to that, it was always foremen, like foremen were made from within. After, in the seventies, they changed. They put an ad in the paper somewhere and they hired people to be supervisors. It was education and management skills that they were looking for instead of work skills... it's not a positive thing. See I would rather, you know, when you think about it, you have to have some knowledge of the basic job that's going on there to understand what those guys are doing. If you look at a written word, "well, what has he done?" Not just take it at face value. (Bill, interview 1, April 1999)

George's account points to another dimension of the disjuncture between the foreman's and the shop floor knowledge of work processes. He identifies a relationship in which shopfloor knowledge is consciously withheld from the outsider:

George: Okay. In our service shop, that's where our foremen came from, the basic foremen. In the seventies it changed, where they hired outside, unrelated to the shop. Prior to that, it was always foremen, like foremen were made from within. After, in the seventies, they changed. They put an ad in the paper somewhere and they hired people to be supervisors. It was education and management skills that they were looking for instead of work skills. To be quite honest with you, I don't think it was the way to go. Only because— These were good people, some of them were good people but they didn't know anything. And I mean, we're like children down there, we're children down in that plant and—

I: You mean you're treated like children?

George: Well, we're treated like children but we're also children back. Like if you don't treat us nice, we're not going to tell you anything... You know? And a supervisor can come out and if you don't know the job, if you don't know the basic skills of the job, I always call us a brotherhood, but the brothers, they can make you or break you or they can.... No, it's not a positive thing. See I would rather, you know, when you think about it, you have

to have some knowledge of the basic job that's going on there,... to understand what those guys are doing. If you look at a written word, a type sheet, well what has he done here? Not just take it for face value.... (George, September 1999)

Part IV: Experiential Learning

Our focus in the previous section of the monograph has been the ways in which restructuring in the steel industry undermines the traditional ways in which non-formal skills in the use of tools and manual skills in general are reproduced. But, of course, experiential learning still goes on. What is disrupted or displaced is its *integration* into the industrial process on more than an individual basis. By the term 'experiential learning' we mean learning that takes place in ways that are not mediated by the text-based systems characteristic of schooling and college. It is a historical process. This is a kind of human capital stored in the individual's own history in the company and available to it only as such an individual continues to work there or as he or she passes it on to others. There is no formal recognition of such knowledge.

Everyday work settings are the contexts of experiential learning. An individual builds up a knowledge of how to do particular jobs, of the layout of the region of the plant that he or she has worked in, of the idiosyncrasies of particular machines, of how to solve particular problems, and so on. By contrast, formalized skills are stored in texts of various kinds and transmitted in formalized settings of education and training. The transmission of experientially acquired knowledge and skill is from individual to individual in work situations which they share. The plant itself, its physical layout, its organization, its technologies, are essential settings in which experiential skills are developed; they are stored by individuals who have, as we have seen, actively built on their experience to transform it into skills and knowledge; the latter is used in their own work but, apart from those skills that have become bodily responses below the level of consciousness, can also be taught to others. Yet, unless it is incorporated into institutionalized training processes such as apprenticeship, experiential learning has no institutionalized form of transmission.

The experiential knowledge and skills acquired by workers in the course of their everyday work activities is not well defined nor does it appear to be valued by the company. Dan formulated this problem for us. In the passage from our interview with him, Dan is arguing against the company policy during the period of multi-tasking and multi-crafting of taking those already trained in a craft and introducing them to production work so that they could apply their knowledge in a trade to the production process. He points out that this procedure is one that essentially wastes the experiential knowledge that the production worker has built up over time. He asks: rather than introducing people in trades to production work, why not introduce production workers to the skills of a trade?

What does it matter what pipe he fits? Or he's a millwright, what does it matter what pump he works on? Or an electrician, the same thing and so on and so on. But a production worker, that's the guy that says "See that waviness in that strip going down that line? That tells me it's on a gauge." "Well how do you know that? " Well, twenty years of watching it and relating it back to a gauge problem." Or "See that furnace? I've

opened up the door and I looked in there. See the colour of that steel? That steel is about 2500 degrees, it's ready to roll." "Well how do you know that?" "Because I know that sheen that forms on there because for twenty years, I've watched that happen." And the guy beside me said, "See when you see that sheen? Roll it." And it's worked. That's where companies screw up. A perfect example of that down at Stelco was our combining of a production job with a trade job, all right, in our basic end. We said "Let's take trades and let's put them on equipment, and let's put them on jobs so that if the equipment breaks down, the tradesman can fix it." Well, when you start going down that road what you're doing is you're minimizing or belittling the quality of the people you have on the production side. It would have been far better to say, "You know what? Let's take that production guy that we know is going to take twenty years to be proficient on his job, and let's give him a few years of, you know, every so often, training on the mechanical side to supplement our mechanical work for us. That's the way it should be going. But we don't look at it that way. (Don, November 1999)

Extending Dan's reasoning suggests that we think of experiential learning and its transmission as distinctive in this way: that it is built up biographically in an individual's everyday world of working. In contrast to formalized learning that is standardized and text-mediated, experiential learning secretes the historical specifics of a local situation, the way in which the particularities of a work setting come to be identified in an individual's consciousness as a historical pattern, repeated in a particular location, a particular configuration of a local setting, a machine process with a particular history. Since what counts as experiential learning is defined by the work or job it relates to, it's hardly surprising that it appears in many forms in our conversations with respondents.

There is some experiential learning that becomes through repetition built into an individual's bodily processes. It becomes automatic:

Jim: ...you had to make sure that area was cleaned up to put some stuff - You didn't want to put the new stuff on top of the old stuff, okay. Because usually the old stuff would be going out first, and then usually we used to hook it up with chains, you get the lifts over there, you can only pile them up so high. You used to have a tape measure. Used to be you could only go about 6 inches high, because of chains, you know, you don't want to do more than that. So for a while, I used to go with a measuring tape, but after a while, you can call [I: Eyeball.] yeah, eyeball, you knew it would be six plates you got half an inch there, you had a quarter inch. You knew exactly how many plates you could do. (Jim, September 1999)

What has first to be carefully observed, watched for, done slowly to make sure it's done right, becomes built into a bodily 'habitus' (Bourdieu 1990), a practice of coordinating hand and eye that is a fundamental feature of acquiring bodily skills.

Tony works on the caster. A dangerous job. He describes how, though he is a Health and Safety rep, he goes into certain situations without protective gear. He can count on responses to potential danger that he has built up over time to protect himself:

Tony: A lot of times I see myself, and even as a rep I shouldn't, but I see myself standing

in front of the steel without my safety equipment on. Because it's predictable to me, I know if it's going to splash, you know? I've done it so many times that "Okay, I don't need to put my coat on because we're dealing with this." But ninety percent of the time, it's a law that you need to wear your safety equipment but a lot of time I go in without it because I've seen the operation enough that I know I'm safe now. And all I've got to do is step back if anything happens. (Tony, September 1999)

What would be true for him, however, is not true for students on site during the summer months.

But the students that come in, you don't want to see them get burned. And "just because I don't wear my gear doesn't mean that you can't. You put your gear on." And if I have to set an example for the person, I'll do the same thing [put my gear on].... I don't want them coming back to me saying, "Well, Tony trained me but he didn't have his gear on either."... So, yeah, we bring them in and we try and teach them the right way. (Tony, September 1999)

We don't want to suggest by the term 'experiential learning' that learning is passive, that individuals are somehow impacted by an environment which goes to work on them without their conscious participation. This is not at all what we learned from those we interviewed. They were actively interested in learning. "I love to learn," Bill told us (Bill, interview 2, June 1999) and his account of how he goes out of his way to observe and learn from others is typical:

I think eighty percent of what I learn, I learn by watching, but if I see a particular guy that I think's good at a job, I'll go and talk to him about it. The other guys I just watch because, you know, for the most part people do things differently like little different shortcuts they've [worked out] and I'll just watch them all, eventually figure the one I feel that makes the most sense. (Bill, interview 2, June 1999)

Bill is attentive and selective; he learns by watching and mulling over what he sees in terms of how it makes sense for his own practice.

Another type experiential learning involves the synthesis of multiple cues in an explicit formulation of a problem or state of affairs. However technologically standardized,, a plant is a particular location. It has a history. Machines have histories. Histories are sedimented in actual performance or interconnections that are not recognized in or anticipated by what is formalized in management or in formal learning processes. They are, however, recurrent features, events, or problems in the local setting:

Steve: But the biggest thing is most things re-occur and most things that I fix, it's not because I was really smart, it's that I have a good memory and I would think back three years ago, on afternoon shift, I know it's up there, so I go and it might take me five minutes to refresh myself but sure enough it's the same problem as happened three years previous.

I: So you know what you're looking for.

Steve: You know what you're looking for. And three years previous it might have taken four hours to find the problem, now it's taking me ten minutes. And it's something that I don't think the company appreciates. (Steve January 2000)

The standardization of formalized procedures, however refined, cannot escape the particularizing

history of their everyday operation in the particular relations of a given setting . It is this that experiential knowledge and experiential learning distinctively taps. We do not mean, of course, to suggest that experiential knowledge cannot be transmitted. On the contrary. But it belongs in the particular setting in which it is acquired and the particular configuration of relations it articulates. An example here will help. Here is Steve (at the time of which he speaks he was an instrument technician):

> *Steve: You're a lot more proficient when you've worked in an area for a long time, because you look at the charts, you look at the flow. Quite often the problem that you're experiencing isn't the instrument at all, it's something to do with the process. And you can look at the process and say "Well, you're doing this wrong and this is happening."A good example of that is one of the controls that we work on is where they wind up coils of steel, coils that are galvanized. We have a control that keeps the edge nice and straight. It's like a roll of toilet paper, the control follows where the strip is, so that you have a nice even edge on it. We've had a problem for years where when the [inaudible] really digs six foot diameter coils you know, maybe 20-ton coils, that they'd end up a little bit like a dish. And our controls were working perfect. But what we found is, the inner steel was slipping on the steel mantle where it was being wound, and when it would slip, it would always seem to move to the same direction very slightly. So that by the time they finished this 20-ton coil, there would be a 4-inch dish to it. But our controls were working perfectly. So what we actually, how we demonstrated it, is we got them to take some peel and stick tape, put it on the manual where it wouldn't slip—the coil would come out perfect, the next one. So then they would take the trouble to wash the mantle off and make sure it was nice and clean. And everything would be fine for about six months. But after you've experienced the problem a few times, you'd go and show the supervisor that mill, "Look, it's not our problem, look at these scratch marks in the coil, you see how they're curved? That's what's happening." And it's experience on the job.* (Steve, January 2000)

Of course, as we can see from Steve's story, experiential learning is an active process. The tendency of the coil to develop a dish-shape is first observed, puzzled about; a procedure is devised to test possible solutions, and a definite interpretation is arrived at: "look at these scratch marks in the coil, you see how they're curved? That's what's happening." Experiential learning operates within the framework of the productive process. This orientation defines what is relevant to be learned. It is an active process in which what is observed, looked for, practised and conceptually assembled is made relevant to the job at hand. It complements the technology:

> *Alison: As Utilities Gas Tester, you're going to meet dangers of carbon monoxide, because I'm doing the gas test for everybody else, okay. As a Water Re-circulation Operator, because I carry this monitor around with me, I have learned just from walking around, where to expect gas. It has, the carbon monoxide has no odour but what I find in the blast furnace area is that where you have a certain odor, the chances of you having a high carbon monoxide level are great. [D: Yes.] It's just this smell that you get. And so you can sort of tell, like sometimes it's so loud down there, you can't even hear your monitor but I'll smell this thing, right, and then I'll look down and I'll see, like has the*

little red light flashes when it has like a beep-beep, I mean, you might have ear muffs on and so on. So if I smell this odour— And then I would tell that to anybody coming in, like that's the odour. Like "Smell that?," like I might take them to a place where I know you get that smell, "Do you smell that? It sort of stings your nose a bit? Well, usually that means there is a lot of carbon monoxide associated with that." Not always but— You know it's just some of the things. (Alison, interview 2, June 1999)

This process of learning goes from the experiential to the conceptual level. What becomes knowledge cannot be observed but has to be assembled conceptually to be given relevance. An individual's own local history in his or her work is a resource which can be drawn upon to assemble a picture of what's going on or to find solutions to problems. Alison described a situation arising from an unanticipated interaction between two systems. She has built up over time a conceptual 'model' of the relations among what is going on in different settings. Presumably plant operations in these units are not directly coordinated with one another so workers in each setting do not experience the relations between what is going on where they work with what is going on in other units. Alison, however, works in Utilities and moves around among different settings. Over time, she has come to assemble events occurring in one setting with those in others so that an event occurring in one setting can be linked to events in another, as we see in this account:

Alison: Yes. It's quite interesting where I work now because I can relate, like I know how each individual thing affects the other. Right?... So these people have always worked that job and they don't understand how their system would relate to our system, and they're looking at them like— Well you know that water— they never knew where that water— They just knew they pumped it somewhere but they didn't understand that they pumped— [I: That it went somewhere--] That it went over there, that we reused it for something else, you know, and so on and so forth....

I: Yeah. So you presumably kind of build up a larger picture of what the processes are in the plant?....

Alison: Yes, it enters into your skills because, for instance, I had a problem a couple of weeks ago. I noticed that the water had turned a certain colour, I just noticed it while I was doing my samples. At the same time, I also had a problem, they had called me to the furnace because they were having a problem with the level control. We took care of that problem with the level control. And I never really gave it much thought. A couple of weeks later, we had the same problem with the level control and I noticed that the water was the same colour again. Hey! So then you're sort of there, thinking "Okay, now why is that?" And then you start delving in a little bit and you start thinking "Well, it's not the usual colour, what have they changed in their process?"... So then you talk to the Blower and you would say "Okay, what have you done?" He would tell me he did something or other and I would say "Oh, well maybe you should call me and tell me that you're doing this so I could shut a chemical off." Because this particular chemical, when he shut off his, he changed his process, then I should have changed my process, okay. Which we didn't, which in turn caused this level control to go screwy. So by noticing that the water colour

had changed, I delved into a little bit of what he had done.... And so now I can say "Okay, well from now on when you do this, please notify me. I will turn off my chemical and this will not cause us all this problem on this level control."... So it helps to be observant, you know, that type of thing. (Alison, April 1999)

Yet another form of experiential knowledge that was described is in a sense learned from the machine process itself. I Again, I want to avoid suggesting that this is a passive process. We can see in the following passage from our interview with Tony a process of active reflection that is at work in how he learns.

Tony: This was a brand new machine—I don't know if they said it was [a] 300 million dollar casting machine. And actually from the very start (it was June of '87) they had us in the plant. It was still under construction actually, the machine was. And what they were doing was they were sending us to Lake Erie Works to learn their casting machine out there... so I shuttled—rented vans or whatever the heck they were called. They would take us up to Lake Erie.... We'd go up there and watch how their machine worked because ours wasn't ready yet. So in a way we were all learning together, back then. Now just from sitting there and watching the machine work and all, you look at it and think "Well, yeah, you can do this and you can do that." You learn things or pick up things on your own.... (Tony, April 1999)

Tony currently works as utility man on the caster that was installed at Stelco in Hamilton. Though it is a continuous process, it has to be watched and controlled.

Tony: It's just massive, it's humungous, for one thing. To get to our work site we have to go probably five stories up in the air. We're dealing with ladles of steel, liquid steel, 150 tons of liquid steel. And they get put on to this thing called a turret and then spun around into position.... The crane picks them up from one area and brings them up to us on the machine. And then from one aisle to the next [the turret] spins the ladle around into position; the ladle of liquid steel gets opened.... On top of this is a thing called a ton-dish. Basically it's just a giant bathtub. The ton-dish fills up from one end and on the other end, on the bottom, the steel comes out of these ceramic things called shrouds and it fills the mould. And then the steel runs through this machine that's shaped like a banana. The steel ends up going through the machine; it comes out horizontal. And in the end it's red hot but solid.... And there's a machine at the end of the line that cuts it up just like butter. For us back then, like for me in particular, it was—I'd never seen liquid steel before. From afar, yes. But to be standing right up close to it, you know, it's— I'd never seen it before. It's hot; it sparks; it's very dangerous; it's unpredictable. There's things you need to learn around liquid steel—like that water and steel don't mix. But just being around it, I guess, you learn. And that's where I've been for the past, well, what is it now, twelve, thirteen years? (Tony, April 1999)

George describes his experience of training on the roll-grinders as an active process of observation of and reflection on the machine process itself.

I: And was it a difficult thing to sort of learn this job?

George: You would maybe watch for maybe one or two rolls. It was a hands-on learning

experience, hands-on, strictly hands-on. So the more time you were allowed to actually do the work, the better you could absorb. Stuff that you had, because you were going from machine to machine, like I just took down notes, specifics like for the changeovers, I keep using that word, changeovers, but for setting up the machines, you know. I'd put that in a little book and you keep that book because when you started doing the relief, you didn't always want to be asking somebody, you wanted to feel you were a little bit confident doing your job, eh. So most of it was all hands-on, you learned hands-on.

And finally, there is another kind of learning altogether that is not defined by the job but arises from reflection on experiences in which the individual discovers aspects of his relationship to the company of which he had not been aware before. Tony learned from a potentially very serious accident:

Tony: There was a few times where I put myself into positions where I risked my life.... The last particular time was, I think, four or five years ago, I got splashed in the face with hot hydraulic fluid and I ended up getting second degree burns. And back then, like not so much myself but my family, like "Was it worth it? Like look at your face, look in the mirror. Your lips are burned, your nose, you know, you could have lost your eye." "Yeah, you're right, it's not worth it." So I'm at a point now where, if I see any danger at all, I just walk away. You know? The machine is the machine but my life is my life.

I: So when you look back on that accident, there was something that you did then that you felt....

Tony: I had to do it to keep the machine.... I would never do it again, no.

I: You were trying to keep the machine going?

Tony: That's right. Now I would say, "If you want that machine to go," to the supervisor, "Do it yourself." Like, back then I thought "Well, we got to keep the machine going." Well, it's more important to keep me going. Because I have to go home to my kids at the end of the day, I have to go home to my wife. You know.

Tony: So you were under some pressure from the supervisor at that time?

Tony: Sure. I was thinking yeah, that's part of my job, I need to change that hose. And even though it's under pressure, well it still needs to be done. Well, you know what? I don't think that's safe. And being a Safety and Health rep, I know that the government's always been on my side with the Occupational Safety and Health Act, to say if I refuse to do that job, it's not going to affect my position here. I'm doing it because I don't feel it is safe and I'm not here to get hurt or get killed. I don't want to do that job because it's unsafe. So I can refuse to do it under the Act, say "That's under pressure there. I'm not touching that." You know? You cool it down and make it proper for me and then I'll go in there because that's my job. But to go in there and risk getting burned? It happened to me before, it's not going to happen again. And then you look at the liquid steel. If a breakout occurs and I feel that I'm in danger of getting my legs burned and my arms burned, I'm going to run like hell. It's not worth it to me to go home maimed or burned or— To save what, to save a machine that they can rebuild in three days? No.

I: So there are other kinds of things that you learned that such a mixture of experience of

working teaches you things.

Tony: Sure. It's more important for you to come out of there every day in one piece than to risk your life. In the position we're in, we're dealing with an extreme situation. Liquid steel going into this hole. I mean, it works, everything happens the way it's supposed to happen but at any time, something could occur and it's up to you. Like I called myself a babysitter when I do the Operator's job because essentially you're sitting there watching this machine work. If I feel at any time that my life is in danger, I know I can push the stop button that stops the flow of steel

I: And you've got to get out of there.

Tony: And then get out of there. And then if there's any damage to the machine, well "Stelco, I'm sorry that that happened but I felt that my life was in danger, I needed to run."

Tony passes on the awareness of danger to students who train with him:

Tony: That's the first thing I tell any student coming in....

I: You do tell them.

Tony: If ever you feel for your life, a gut feeling even, you turn around and walk back in the lunch room and then we'll talk about it in the lunch room, not on the job. (Tony, April 1999)

Like Tony, George has learned something about himself, his life and his relationship to Stelco. Not something easily communicable. It is a deep disillusion:

George: Stelco is a job, period. A job. You do enough to save your posterior, that's the end of it. Because you learn— I'm going to be honest here, like you learn within, if you don't learn within a year, you're going to be very frustrated. And I didn't learn within a year, you know. [I: You didn't learn?] The way things are done down there, they're-- Nobody wants to improve things. And I'm talking about supervision. And when you're there and you say "Well, why don't we do this" or "Why don't we do that?" "Well, we've done it like this for that many years, it stays that way." It's not a progressive thing, you know, it's not. And for anybody that cares, like you just get browbeaten and browbeaten and browbeaten. So you're better off just getting in that whole mould in there and stay in there. And like take pride in your ability to do your work well. And if they would ever question you on something, that you've got the right answers. That's where I come from at work. But as far as the pride at work, no. Like you just do the work well. I'm proud of my work in the sense that, at work, that it's done well. But I don't worry about it in the sense that this is contributing to Stelco, or this is contributing to Stelco.... No. That's taken out of you a long, long time ago. That's taken out of you. (George, September 1999)

Part V: Conclusion

The introductory section of this paper expanded on Harry Braverman's theme of the expropriation of working class skills by the new forms of managerial technology he identified with Frederick Winslow Taylor's school of scientific management. His original conception was relocated here in an account of a more general reorganization of society, starting in the late nineteenth century, that

went beyond the internal relations of the industrial enterprise to an expanding expropriation of localized forms of organization and agency. Some of these were introduced by new forms of the organization of capitalist enterprise and others by the development of complementary forms of organizing government and the production and applications of knowledge in universities and professions. The term 'the ruling relations' is used to identify this increasingly interconnected, dense and expansive complex of objectified forms of organization and relations, expanded beyond Taylor's dreams by the increasing use of electronic forms of control and guidance (Zuboff 1984; Vallas and Beck 1996).

The primary research resource on which this study is based is a series of interviews with people working at Stelco whose worklife experience spans the period before restructuring, starting in the late 1960s or early 1970s, to 2000 when our interviewing concluded. This research was complemented by other sources in the ethnographic literature, an earlier study of the plastic industry by George Smith and myself, and relevant government documents. Our interviews were focussed on how people learned the kinds of skills they used in the plant and on the skills they had acquired in the context of the everyday relationships of family, neighbours and friends. The latter enabled a picture to be drawn of the ways in which a working class community stored and transmitted manual/mechanical skills across generations and among peers. Working class communities associated with the major industries of the previous era were sustained economically by the industries with which they were associated, but they also brought to those industries the human capital that was regenerated invisibly in the community. The exchange of skills among community members in renovating homes, doing repairs, fixing cars and so on also contributed to its general wealth. Restructuring undermines this social organization because it has radically reduced the numbers of high-paying industrial positions on which it was built. We do not know what the effects of this may be, in part because presumably these skills resources have become a resource for the smaller enterprises to which some at least of the original functions of the larger companies have been contracted out. Nonetheless, clearly the conditions that created this important reservoir of human capital have gone.

The third part of the study is its centrepiece. Its interest is in the transfer of skills training from among workers in the industrial setting to the formalized textually-mediated forms of the ruling relations. An example of a plastics company in which the supervisory staff and even management have come from the shopfloor is used to highlight the kinds of changes that have taken place in industry in general and in Stelco's Hamilton plant in particular. Drawing on the interview material, the kinds of training characteristic of the plant prior to restructuring is described, showing the extent to which in the earlier period training was almost entirely from worker to worker, and foremen were drawn from the shop floor and shared the knowledge of operations with other workers. Restructuring, an uneven but continuous process from the late 1970s on, progressively eliminates these forms of learning which is increasingly transferred to formalized bases outside the plant. Formerly almost all the training at Stelco was internal, supplemented for technicians by some community college or high school classes. Over the period explored, more and more those hired into the company into supervisory positions have formal educational qualifications and no experience of the job they supervise. Increasingly also those few

recently hired into the company also have formal educational qualifications beyond high school. The interests of government in reshaping the labour force to meet the demands of the new forms of management as well as of technology conjoin with those of industry. The community college has been reorganized to respond directly to the specific needs of industry. The complex of relations that displace the earlier forms of training controlled at the shopfloor level now integrates industrial management with the educational system, at least at the community college level.

In Part IV, the final section before this conclusion, we bring into view aspects of learning experientially that are relied on yet remain largely invisible and transmitted to others only uncertainly. In contrast with formalized skills that are built up in formalized settings of training, experiential skills and knowledge are built up by the individual in the course of his or her work. It is argued that, regardless of the technical niceties of technology, any machine or electronic process has a history, develops idiosyncrasies, is located in a particular setting, and so on. Experiential learning is responsive to these particularities. It is an active, reflective process in which observations or events become lessons through the thoughtful way in which their relevance to the job are derived. This kind of learning goes on, will go on, is essential, yet lacks recognition and institutional forms in which it is transmitted from individual to individual. It could be said that it is perhaps only in the Health and Safety Committee, a joint committee of Stelco's Hamilton plant and Local 1005 of the United Steelworkers that there is some determinate form in which what is learned under conditions of injury or illness is transformed into learning for the plant and in particular for safety at the shopfloor level. Of course, the Health and Safety Committee is also informed by advances in scientific and technical knowledge in this area, but it clearly also draws on what people know about their working lives and what can be discovered about the everyday working conditions that lead to accidents. Our research did not go extend into this area, but it would be a fruitful area to research in the future and a possible model for how experiential knowledge can be recognized, respected and incorporated into the working knowledge of industry.

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